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THESIS

HUNTING A BLACK SWAN: POLICY OPTIONS FOR AMERICA'S POLICE IN PREVENTING RADIOLOGICAL/NUCLEAR TERRORISM

by

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September 2012

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Local law enforcement is a necessary and irreplaceable component to a comprehensive approach to increasing the probability of detection of attempted Nuclear and Radiological Terrorism incidents. Local law enforcement's unique knowledge, skills, and abilities provide investigative, protection, and direct action capabilities not found in other nonmilitary disciplines. A well-trained, equipped, and situational aware Law Enforcement community can form our nation's last, best defense against this terrorist threat. This thesis will examine the broad policy options for law enforcement agencies pursuing a Preventive Radiological Nuclear Detection (PRND) program. The examination will look at four options: (1) taking no action and leaving the PRND mission to federal agencies, (2) a single agency approach, (3) multiple law enforcement agencies creating a regional PRND program and (4) a multidisciplinary, multiagency approach covering a large urban area. Each option will use a case to illustrate the comparative aspects of planning, organization, equipment, training, exercising, and operations support. It will be shown that interested law enforcement agencies can choose and implement a PRND that meets their needs as part of an overall homeland security program in their respective jurisdiction. The goal is to encourage more law enforcement agencies to participate in the domestic portion of a global strategy known as the Global Nuclear Detection Architecture (GNDA). This document will serve as a roadmap for agencies wishing to engage in this mission.

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HUNTING A BLACK SWAN: POLICY OPTIONS FOR AMERICA'S POLICE IN PREVENTING RADIOLOGICAL/NUCLEAR TERRORISM

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DEDICATION

Robert Forrest, my second reader, passed away suddenly on August 28th, 2012 while vacationing with his family on the Outer Banks of North Carolina, at the age of 46. Second Reader is a title that does not give full justice to Rob's role in this thesis or my life. Rob served as a mentor and friend for the past decade. This thesis is interwoven with his shared drive and commitment of making our nation safer from the threat of radiological and nuclear terrorism. Rob gave freely of his nights and weekends too many times to count, to train a generation of law enforcement officers in the Preventive Radiological Nuclear Detection mission. As a recognized leader in the Health Physics community, he actively assisted the Nuclear Regulatory Commission, The Departments of Energy and Homeland Security, as well as several of the National Laboratories on matters of national security regarding this complex threat. He traveled the world assisting in prevention efforts in modern and developing countries alike to help secure materials that could be used as weapons and raise awareness to the threat. Domestically, he served as a role model for private sector involvement in the Global Nuclear Detection Architecture and has touched many of the programs in the Global Threat Reduction Initiative and others under the direction of the Domestic Nuclear Detection Office, too numerous to list.

I take great solace that Rob died in the company of his family, in a place he enjoyed far from the many fronts in our nation's war on terrorism. Rob wasn't a uniformed soldier or sailor in the fight, but his contributions were significant and his family, friends, and colleagues should remember him proudly.

It is my sincere desire that this document serve as a lasting tribute to Rob for his friendship and support on our shared journey; and a testament to his commitment in making his community, our nation, and the world a safer environment from terrorism.

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The completion of this thesis would not have been possible without the support and assistance of many people. First, I would like to thank the instructors and staff of the Center for Homeland Defense and Security for this incredible learning opportunity. I have attended many types of Homeland Security training and I can say that the CHDS experience is unmatched. I have met and studied with a dedicated and talented group of professionals and some true lifelong friendships were developed. Special thanks are due to Chris Bellavita, my advisor, for helping me navigate through the entire thesis process with most of my sanity intact. Lauren Wollman and Pam Silva helped bring the entire process to a smooth conclusion after the tragic death of my second reader, Rob Forrest.

I would also like to thank my department, especially Police Commissioner Charles H. Ramsey for allowing me the time and support to attend and successfully complete the program. The Commanders and fellow officers of the Homeland Security Bureau were instrumental in assisting me with balancing duties in Philadelphia with coursework and in-residence sessions.

I received tremendous support in terms of personal meetings, numerous phone calls, and email exchanges with my fellow PRND Program Managers. Most notably the contributions of Inspector Stuart Cameron from the Suffolk County, New York Police Department and Sergeant Mick Kelleher from the Los Angeles County Sheriff's Department, they helped shape this thesis and my PRND program in Philadelphia. My principle partners in the Philadelphia UASI PRND Program, Lieutenant John Godzeiba, Chief Bill Albany, and Deputy Chief Michael Fink, provided support as we continued to hone our local capabilities. Dozens of other colleagues from the Domestic Nuclear Detection Office and PRND programs of every size provided support and encouragement as well.

Most importantly, I would like to thank my family. I have tremendous love and gratitude to my wife, Karyn, for pushing me to finish my undergraduate degree in less than 25 years and then to immediately apply to the NPS Program. She carried the family

load for seven sessions of me being away- all while a master's student herself. During my time at NPS, my son, Nicholas, went from college freshman to junior and my daughter, Sarah, made the transition from my little girl to teenager. I could not have done any of this without the three of them.

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LIST OF ACRONYMS AND ABBREVIATIONS

CBRNE	Chemical, Biological, Radiological, Nuclear, Explosive
DHS	Department of Homeland Security
DNDO	Domestic Nuclear Detection Office
DOE	Department of Energy
GNDA	Global Nuclear Detection Architecture
GTRI	Global Threat Reduction Initiative
HSIN	Homeland Security Information Network
IND	Improvised Nuclear Device
JAC	Joint Analysis Center
MDS	Mobile Detection System
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
NORM	Naturally Occurring Radioactive Material
PRD	Personal Radiation Detector
PRND	Preventive Radiological Nuclear Detection
RAP	Radiological Assistance Program (Department of Energy)
RDD	Radiological Dispersal Device
RED	Radiological Exposure Device
RIID	Radiological Isotope Identification Device
SNM	Special Nuclear Material
TSA	Transportation Security Administration
UASI	Urban Area Security Initiative
USCG	United States Coast Guard
VIPR	Visible Intermodal Protection and Response

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I. HUNTING A BLACK SWAN: POLICY OPTIONS FOR AMERICA'S POLICE IN PREVENTING RADIOLOGICAL/NUCLEAR TERRORISM[1]

Saturday, August 18, 2012 at 2:35 am
Suburban location—Anywhere, United States

Three men enter a darkened building of a mid-size university closed for summer break. The university has unarmed security guards that make periodic checks of the campus building exteriors, and the local law enforcement agency is a county police department that interacts with the university on an "occasional" basis. The men enter a third floor laboratory housing a Cesium 137 irradiator. The irradiator is used by faculty and students to expose tissue samples to high levels of radiation during their research. Using simple tools, they partially dismantle the device and remove the radioactive source capsule containing 3,000 curies of Cesium 137. The three perpetrators move the material in a crudely constructed lead bucket providing light shielding and minimal protection to them, placing the material in a self storage locker ten miles away. The theft goes unnoticed until Monday morning when it is reported to the county police. The county police are not immediately concerned or recognize the significance this type of theft or the amount of radioactive material taken.

Monday, August 21, 2012 at 10:45 am
Urban location—Anywhere, United States

The three perpetrators, over the previous two days, have taken the radioactive material and assembled it with explosives stolen from a construction site into a Radiological Dispersal Device (RDD), commonly called a "dirty bomb." The device has been transported to a medium-sized city, one hundred miles from the university. All three men are suffering from radiation sickness but are able to detonate the device in the city's business and financial district. Seven people, in addition to the three terrorists, are killed

[1] This chapter serves as a "stand-alone" overview or executive summary of law enforcement's role in radiological and nuclear terrorism. An expanded version is contained in Chapters II–V and related appendices.

in the explosion. The resulting contamination from the dispersal of the Cesium 137 will likely produce a public health concern and general panic, as well as significant financial consequences.[2]

The above scenario is fictional but will serve as an introduction to the discussion of what could have been done to deter or interdict the attack. Could the university and local police have had strategies to better secure the radioactive materials that were stolen? Could the local police been notified in a more timely manner through a closer working relationship with university radiation safety professionals? Could police have searched for the material after it been stolen, while in transit and assembly at self storage facility, or while in route to the final target?

The answer to all of these questions is, yes. A number of police agencies, of every size and composition, have undertaken a new mission known as Preventive Radiological / Nuclear Detection (PRND)[3] as part of their jurisdiction's homeland security strategy. These PRND efforts interface with the international effort to prevent nuclear and radiological terrorism known as the Global Nuclear Detection Architecture (GNDA).

Since September 11, 2001, American policing has undergone a fundamental transformation. Traditional crime fighting and the public service mission have been expanded to include roles in the homeland security enterprise. Matters once thought to be squarely within the domain of the United States Government as part of national security have become commonplace at the local level. The area of nuclear and radiological terrorism prevention is an example of this transformation. Most law enforcement officers who began their careers prior to 9/11 would never have envisioned an expanded role in this area, let alone carrying radiation detection equipment as part of their normal patrol duties. An attack of this nature is truly a "black swan" by definition—an extremely remote possibility but with staggeringly high consequences. The successful detonation of a nuclear weapon within the United States today would change our country on a

[2] Estimates vary but several hundreds of millions of dollars is possible. A Los Angeles study is presented later in the thesis for a similar device causing sixteen billion dollars of effect.

[3] PRND is the term used by DNDO to describe the community of agencies, law enforcement and others, involved in the Domestic Interior portion of the GNDA.

unimaginable scale. A lesser impact would result from the use of a radiological dispersal device or RDD, but even that could cost billions to clean up and years from which to recover.

The Global Nuclear Detection Architecture attempts to create a multi-pronged "defense in-depth" strategy that increases the probability of detection and causes a deterrent effect forcing a potential adversary to reconsider if such an attack is likely to succeed. This thesis posits that law enforcement adds a distinctive, if not the last, layer of this worldwide effort. By harnessing law enforcement's unique blend of familiar crime fighting, community policing, and terrorism response skills, they add greatly to the domestic front of nuclear and radiation terrorism prevention.

The examination of law enforcement's role in PRND leads to this thesis and the following research questions:

- *For law enforcement agencies considering becoming involved in an expanded homeland security role, what are the major policy options for implementing and operating a Preventive Nuclear/Radiological Detection (PRND) Program?*

- *What are the costs involved in starting and maintaining the various policy options?*

- *What are the relative factors in the program's management concerning planning, organization, equipment, training, exercises, and operations support that make each option unique?*

It has been debated whether radiological and nuclear terrorism is a viable concern for our nation's homeland security efforts.[4] It is certain that a successful attack[5] would cause significant impact—a nuclear device would likely cause mass causalities, and a radiological dispersal device (RDD), sometimes referred to as a "dirty bomb" may cause widespread economic damage due to contamination as seen in the opening scenario. This

[4] A more thorough examination is contained in Chapter II's Literature Review Section.

[5] Appendix A contains an expanded history of nuclear and radiological, as well as possible types of attacks.

thesis will argue that due to the significance of the consequences, preventive strategies, such as the GNDA, are appropriate and the law enforcement agencies play a critical role in its domestic portion.

In this type of terrorism prevention, the main focus revolves around increasing the probability of detection of the theft, illegal movement, or attempts to utilize radiological or nuclear material as a weapon. The Global Nuclear Detection Architecture (GNDA) is the current United States Government (USG) strategy to increase this probability of detection concept thus creating a layered global and national defense framework.[6] The GNDA is a network of equipment, personnel, and information technologies that are designed to prevent a terrorist organization from obtaining, transporting, and deploying a nuclear or radioactive material-based weapon into the United States. Utilizing existing local law enforcement as the domestic portion of the GNDA is an effective strategy, as it harnesses their ingrained crime prevention mission and advances it with added training and technology.

The role of law enforcement is concentrated in the interior portion of the GNDA. Police are assigned throughout the nation in an ever-present and steadfast deployment mode. The concept that can benefit the GNDA is that law enforcement officers are generally available twenty-four hours a day, every day and although rural areas may experience reduced response times, there is still a responsible jurisdiction for every geographic area. This gives a program like the GNDA a physical advantage by utilizing police that are on patrol. With additional training, equipment, and procedures related to the GNDA, police officers could seamlessly mesh their existing duties with counterterrorism, thus alleviating the expense of dedicated detection personnel.

Law enforcement officers possess skills that make their inclusion in Preventive Radiological Nuclear Detection (PRND) efforts desirable. These include:

Situational Awareness: No one is more familiar with his or her respective community then the patrol officers responsible for its protection on a daily basis. These

[6] (Department of Homeland Security 2010) 9.

officers are trained and positioned to notice when conditions change and detect suspicious behavior. They are naturally inquisitive to situations, persons, and other activities, which do not fit the usual patterns in a given area. This skill is developed and honed over the course of a career and is extremely difficult to duplicate with an individual encountering an area for the first time, particularly during an actual event.

Interview/Interrogation Skills: Police officers spend most of their time interacting with the public, e.g., criminal suspects, victims, witnesses, and the general population. With this interaction, they develop a sense of when a person is being truthful or deceptive. They make quick and efficient size-ups in the first few seconds of any interaction. This is a basic survival skill that like situational awareness is honed over the course of time and continues to improve and evolve.

Detention and Arrest Authority: Most nonlaw enforcement participants in the GNDA do not possess the statutory authority to stop, question, detain, and arrest individuals. This is a critical component when considering that the primary goal is not merely to find radioactive and nuclear material but to also stop individuals from using such product as a weapon. Any person can be trained to use instruments to locate these substances, but having the legal ability to engage perpetrators without hesitation is fundamental.

Use of Force: It cannot be stated strongly enough that the goal of preventing radiological and nuclear terrorism is to identify and locate the persons responsible and recover all illicit materials being used. In simplest terms, it is reasonable to assume that there will be persons present with the materials that will not willingly surrender it. As explained in the arrest/detention section, the ability to actually stop the incident from occurring is the focus. This requires being able to properly and effectively utilize force, including lethal force, a critical dimension that resides in the expertise of law enforcement.

There are four broad Preventive Radiological Nuclear Detection Operations (PRND) mission types that law enforcement agencies can perform. The four missions[7] are:

- Radiological Material and Site Protection / Response: Law enforcement can assist in the security of known locations where radiological and nuclear materials are stored or used.
- Steady State: 24/7 deployment of detection equipment by patrol personnel.
- Special Event / Enhanced Steady State: Adding PRND personnel to the security of special events from National Security Special Events to local venues.
- Surge / Intelligence Driven: Deploying PRND personnel based on Threat Information
- Within each of the above are three common mission activities:
- Primary Screening: Making "first detection" or contact with a radioactive material. Under either innocent or illicit circumstances.
- Secondary Screening: Determine if the material detected is innocent or illicit in nature.
- Technical Reach-Back: Receiving assistance from federal authorities including the FBI and National Laboratories to make a final determination of the materials use or threat.

There are applications for the entire mission and activities listed above in the opening terrorism scenario. Trained and equipped law enforcement officers may have had several opportunities to detect and interdict the attack pathway depicted that will become evident. Before beginning PRND operations, a law enforcement agency must choose a policy option under which to operate their program.

This research examines four policy options:

- No Local Action – PRND is solely a federal responsibility
- Single Agency PRND Program
- Multi-Agency PRND Program
- Multi-Agency / Multi-Discipline PRND Programs

[7] Additional information on PRND Missions, Activities, and Equipment is contained in Appendix B.

Each of the four PRND policy models will be presented as a case study using an actual department's program, with an overview. They will then proceed through six POETE/Ops factors taken from the DHS-DNDO Program Management Handbook. The factors are:

1. **Planning**- Develop a program strategy, begin and manage a PRND Program.[8]

2. **Organization**- Organizational Design and Staffing a PRND Program.[9]

3. **Equipment**- Selection, Acquisition, and Maintenance.[10]

4. **Training**- Develop, Establish, and Manage program Training. [11]

5. **Exercises**- Develop, Establish, and Manage program Exercises.[12]

6. **Operations Support**- Technical Reach-back and Information Sharing Support including from federal assets.[13]

A matrix will follow in Chapter V depicting the relative strengths and weaknesses of each option. Assessment criteria include NIMS typing, training costs, equipment and sustainment costs, and an overall program ranking. The final program rank is scaled using a Limited, Good, Better, Best format and includes supporting text descriptions.

Below are the general descriptions of each program model found in Chapter III:

No Local Action—PRND is a Federal Responsibility

This represents no local action on part of nonfederal law enforcement agencies. An agency, after reviewing threat information, decides not to create a PRND program due to actual or perceived barriers such as funding. Their conclusion is that the GNDA

[8] (DHS-DNDO Program Handbook) Planning 1.

[9] Ibid., Organization 1.

[10] Ibid., Equipment 1.

[11] Ibid., Training 1.

[12] Ibid., Exercises 1.

[13] Ibid., Operations Support 1.

effort is not in the purview of local law enforcement and remains within the sphere of United States Government (USG) agencies in the national security arena. The Transportation Security Administration's Visible Intermodal Protection and Response Team (TSA VIPR) is used as the case study for this program.

Embarking Alone—Single Law Enforcement Agency Program

This is a program that includes only the originating law enforcement agency. This is the first step in a progressive program that begins with training and equipping a limited number of personnel. The Los Angeles County Sheriff's Department is used as the case study for analysis in Chapter IV.

Working with Law Enforcement Peers—Multi-Agency Law Enforcement Program

This involves the originating agency and surrounding law enforcement entities working in a cooperative program to provide wider prevention coverage. An example would be multiple police departments working together in an Urban Area Security Initiative (UASI) region. The Philadelphia Police Department's involvement in the Philadelphia UASI PRND program will be used as the case study for this program.

Working with all Response Partners—Multi-Discipline/Multi-Agency PRND Program

This requires the participation of a number of agencies from several geographic jurisdictions and from one or more additional public safety agencies such as Fire, EMS, Public Health, as well as state and private sector radiological professionals. This program option combines the inherent strengths of law enforcement in counterterrorism programs with the technical expertise and response capabilities of other first responders. The Suffolk County Police Department's involvement in the "Securing the Cities"[14] initiative will be used as the case study for this program.

[14] Securing the Cities is a federal grant funded PRND in the New York City Region discussed in detail in Chapter III.

Tables 1 and 2 provide a snapshot of the results of the analysis in Chapter IV. Then results are elaborated in the Findings Section of Chapter VI:

Table 1. Analysis Matrix (POETE-Ops)

Program Model	**Planning**	**Organization**	**Equipment**	**Training**	**Exercises**	**Operations Support**
Fed PRND	LIMITED	LIMITED	LIMITED	LIMITED	LIMITED	BEST
Single Agency	GOOD	GOOD	BEST	GOOD	GOOD	BEST
Multi-Agency	BETTER	BETTER	BEST	BEST	BETTER	BEST
Multi-Discipline / Multi-Agency	BEST	BEST	BEST	BEST	BEST	BEST

Table 2. Analysis Matrix (Costs, Interoperability, Expandability)

Program Model	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
Fed PRND	VARIES	VARIES	VARIES	LIMITED	YES	**LIMITED**
Single Agency	$1,755,000	$274,500	$86,000	YES	YES	**GOOD**
Multi-Agency	$600,000	$271,000	$86,000	YES	YES	**BETTER**
Multi-Discipline / Multi-Agency	$1,639,000	$1,350,000	$102,900	YES	YES	**BEST**

There are expenses associated with this effort. In terms of personnel, training, procuring equipment and sustainment, costs can be substantial. Some agencies may find their involvement cost prohibitive and choose to leave the mission to federal authorities. Economic hardships and competing attention with more traditional crime prevention and response duties will tax some agencies to the point where this additional duty is not practical. Others will choose a policy option presented here and join the PRND effort at a time appropriate for their agency. Programs will vary in size and scope. However, every case study presented is scalable. Larger agencies and their programs were used as examples but the management criteria apply to departments of every geographical and personnel size. The principle missions—Steady—State, Enhanced Steady State/Special Event, and Intelligence-Driven search operations, are found in every community in varying degrees. The knowledge that such operations exist at the federal level may merely raise awareness in some departments. They can, in turn, at least plan for basic support and participation if the need arises in their communities.

Law enforcement agencies, including some used as case studies in this thesis, decided to embrace this mission and added to the layered defense and protection of our nation as envisioned by the GNDA. Increasing police participation only heightens the probability of detection and enhances all of law enforcement's roles in homeland security and defense.

Agencies are strongly encouraged to educate their personnel on the reality of radiological and nuclear threats, locate and liaise with sites and organizations that store and use radioactive material, and assist in the physical security and response to those sites. They must also partner with organizations actively pursuing the PRND mission to provide an ever increasing blanket of overlapping detection and deterrent capability. This recommended strategy is expressed as PREPARE, PROTECT, PARTNER, and PROVIDE.

A. PREPARE

The first step is to make the decision that it worthwhile for the law enforcement agency to engage in PRND efforts. This can take several forms and does not necessarily entail creating a formal PRND program. Many agencies begin at the preparation step and logically grow as funding and capabilities expand.

An agency can begin by educating its employees about the threat of nuclear and radiological terrorism. There are a number of web-based training courses that can be accessed on FEMA's website (www.fema.gov) that cover awareness level material. The Domestic Nuclear Detection Office is in the process of creating training products aimed at executive leaders and elected officials in a similar focus. If the majority of law enforcement officers took as little as two hours to educate themselves on the threat, became more aware of the materials that are used and transported within and around their communities, it would increase the probability of detection and enhance the deterrence factor without purchasing any equipment.

The next step would be for an agency to locate and develop a relationship with sites and organizations that use, store, or transport nuclear and radioactive materials.

These include hospitals, universities, industrial sites, government laboratories, power generating stations, and waste facilities. It is advantageous to have an existing relationship and discuss mutual concerns such as emergency response to the site before to an incident occurs. Patrol officers making random unscheduled visits to these sites can discourage the "insider" threat discussed in the background section. If employees see there is a strong relationship between law enforcement and their organization, they may be encouraged to share intelligence and information, and be deterred from becoming involved in a terrorism event. Similar to awareness training, the relationship component is cost neutral and can singularly increase the strategic goals of the GNDA.

B. PROTECT

Once the education and liaison steps are fulfilled, the path continues to site and community. The National Nuclear Security Administration's (NNSA) Global Threat Reduction Initiative (GTRI) seeks to add voluntary, government funded, security upgrades to physical locations that store and use radioactive materials that could be used to make a radiological dispersal device (RDD). The most common type of sites involved in the program are hospitals with Cesium or Cobalt blood irradiators. The GTRI program also provides training and equipment, such as personal radiation detectors (PRDs), to local law enforcement agencies that are responsibility for protection and response to a site. The program also provides training on the use of PRDs, as well as a three-year maintenance, calibration, and sustainment program to offset costs to the agency. Several programs evaluated in this document benefited greatly from this initiative and built their capability by being involved in NNSA's effort to secure sites across the nation. Agencies are strongly encouraged to explore this as an option to begin or augment their PRND efforts.

C. PARTNER

Collaboration is cited throughout the homeland security enterprise as critical and is equally important in the Preventive Radiological / Nuclear Detection (PRND) program model. In the recommendations above, locating and establishing a relationship with at-

risk sites in their patrol areas begins the process of partnering. It is further enhanced by inclusion in the GTRI program if available in the respective jurisdiction. If not, agencies should consider initiating a smaller effort—a NIMS Type IV[15] or nontyped operation by placing several PRDs in the hands of patrol personnel. By establishing a relationship with other response agencies, such as fire, hazardous materials, radiation safety professionals, or the National Guard Civil Support Team, a program can expand through the collaboration and costs spread across several budgets. The NIMS Typing information in Appendix C provides more information on joint multi-disciplinary PRND teams. It is stressed throughout this thesis that law enforcement's openness to collaboration is critical and inclusion in existing nonlaw enforcement efforts can be a powerful force multiplier. If equipment cannot be acquired due to funding or other constraints, agencies should strongly consider providing personnel to existing detection efforts implemented by other organizations to add the interviewing/interrogation, arrest/detention, and use of force expertise not indigenous to other disciplines. This again represents a low or no cost option for inclusion in nationwide PRND efforts and benefits all the agencies involved.

D. PROVIDE

By educating its personnel, partnering with other public and private organizations, and arming its staff with detection and interdiction equipment, law enforcement provides another layer of the Global Nuclear Detection Architecture. The GNDA begins overseas by protecting sites in foreign countries storing at-risk material, then protects our borders by scanning cargo at foreign ports and domestic border crossings, but truly ends in the realm of America’s police whose inclusion provides a unique blend of traditional crime fighting with a role in national security.

Agencies should strongly consider examining the PRND programs detailed in this document to find a starting point to begin involvement in the prevention of nuclear and radiation terrorism. The first three steps can be adjusted as funding and personnel resources are available. Note that not every agency needs to develop a NIMS Type I

[15] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety.

PRND operation. Substantial financial resources support several programs contained herein and most jurisdictions do not have access to that level of homeland security funding. All agencies can participate whether in awareness training or building relationships with existing stakeholders.

America's police have a long and proud history of protecting its communities and citizenry. It transformed itself in the wake of the tragedy of September 11 and rose to the new mission of terrorism prevention, as well as crime related and public safety duties. Its members significantly contribute to the PRND mission and fill a critical function in the GNDA. By taking an active role in these operations, they may very well prevent the most horrific attack that our nation has ever endured. Law enforcement officers serve as hunters against this "black swan" and our nation and the entire world benefit from their service.

II. THE ROLE OF LAW ENFORCEMENT IN NUCLEAR AND RADIOLOGICAL TERRORISM

A. RESEARCH QUESTIONS: DEFINING THE ROLE OF LAW ENFORCEMENT IN NUCLEAR/RADIATION DETECTION

For law enforcement agencies considering becoming involved in an expanded homeland security role, what are the major policy options for implementing and operating a Preventive Nuclear/Radiological Detection (PRND) Program? What are the costs involved in starting and maintaining the various policy options? What are the relative factors in the program's management concerning planning, organization, equipment, training, exercises, and operations support that make each option unique?

B. PROBLEM SPACE: RADIOLOGICAL AND NUCLEAR TERRORISM PREVENTION

1. Radiological/Nuclear Threats and Prevention Efforts by Law Enforcement

Nonfederal law enforcement agencies have a critical role in the larger international effort to prevent nuclear/radiological terrorism. The research will describe four program options that agencies could consider in expanding their counterterrorism efforts to include Preventive Radiological/Nuclear Detection (PRND). It shall present the advantages and disadvantages of each policy model using case studies to further illustrate each option.

The reality of a nuclear or radiological-based terrorist attack in the United States may be remote.[16] However, the consequences of an attack are likely to cause significant repercussions in terms of physical and economic costs, public fear and a perception that our adversary has the ability to deploy weapons of mass destruction at the time and location of their choosing. A recent study on a Radiological Dispersal Device, also known as “Dirty Bomb,” in the Los Angeles area estimated the economic impact in

[16] Additional background and reference material on Nuclear and Radiological Terrorism is contained in Appendix A.

excess of $16 billion dollars.[17] The attack in that study caused 180 fatalities, 270 injuries and contaminated 36 square city blocks of downtown Los Angeles but had lingering economic and psychological effects for years beyond.[18] Low probability, high impact terrorism scenarios such as this illustrate the need for deterrence and prevention initiatives at all levels of government both internationally and domestically. This discussion will focus on the domestic portion of an overall international prevention effort and advocate a significant role for law enforcement. In prevention, a main focus revolves around increasing the probability of detection of the theft, illegal movement, or attempts to utilize radiological or nuclear material as a weapon. The Global Nuclear Detection Architecture (GNDA) is the current United States Government (USG) strategy to increase this probability of detection concept thus creating a layered global and national defense framework.[19]

The GNDA is a network of equipment, personnel, and information technologies that are designed to prevent a terrorist organization from obtaining, transporting, and deploying a nuclear or radioactive material-based weapon into the United States. Two National Planning Scenarios center on these types of attacks—Scenario #1 analyses an event with an Improvised Nuclear Device and Scenario # 11 depicts an event with a Radiological Dispersal Device.[20] The GNDA begins with our government paying to secure sites in the former Soviet Union and ends domestically with a police officer armed with a radiation detector at the gates to the Super Bowl, World Series, or during routine patrol. Utilizing existing local law enforcement as the domestic portion of the GNDA is an effective strategy, as it harnesses their ingrained crime prevention mission and expands upon it with added training and technology.

The keystone of the domestic strategy is that law enforcement agencies must add a PRND program to their homeland security/counterterrorism deployment that meets

[17] (Giesecke et al., April 2012) 583.

[18] Ibid., 585.

[19] (Department of Homeland Security 2010) 9.

[20] (Department of Homeland Security 2005) 3.

their respective jurisdiction's ability and is flexible and scalable as partners and resources become available. Law enforcement has a unique role as the last, best defense in the GNDA chain, and its capabilities have yet to be fully studied in this arena. This examination will strive to explore this topic in an organized, intelligent fashion to support a position of expanding law enforcement's participation in the GNDA objective by providing a policy option pathway for implementing and maintaining a Preventive Radiological / Nuclear Detection (PRND) Program.

The next section will outline the ideas of deterrence and increasing the probability of detection, as they are the foundations of the current GNDA strategy. It expands upon the GNDA concept, its objectives, and component parts in an effort to strengthen the argument that law enforcement plays a vital role in its domestic expansion. By understanding the theory and application of the GNDA, an agency can be better prepared to make an informed decision on committing personnel and resources to this effort.

2. Prevention Efforts by Law Enforcement

a. General Deterrence and Increasing Probability of Detection

Law enforcement's primary role is prevention. It provides a perception that a particular area is safe from crime and instills in potential criminals a fear of being caught in the course of an illegal act. The same prevention and deterrence used in traditional policing efforts can be used in the effort against radiological and nuclear threats. Police add a valuable layer to the GNDA and assist in providing a deterrent worldwide. The deterrence factor is coupled with proactive security operations that increase the probability of actual detection of the radioactive or nuclear material, as well as other destructive devices constructed with these materials.

One of the prevailing goals in preventing nuclear and radiological terrorism is to increase the chance that those involved or the material involved will be interdicted before act completion or misuse.[21] One way to accomplish this is through a "defense in depth" approach where multiple layers of detection capability are deployed

[21] (White House 2005).

between the individuals and the actions. The Transportation Security Administration (TSA) describes the numerous layers employed at airports throughout the nation for the safety of the travelling public. Below is a graphic representation of the TSA strategy.[22] The concept illustrates that an adversary may be detected, deterred, or interdicted by anyone or any combination of layers. A successful attack would have to defeat all layers and an adversary would be uncertain exactly how many layers they would encounter in any given attempt.

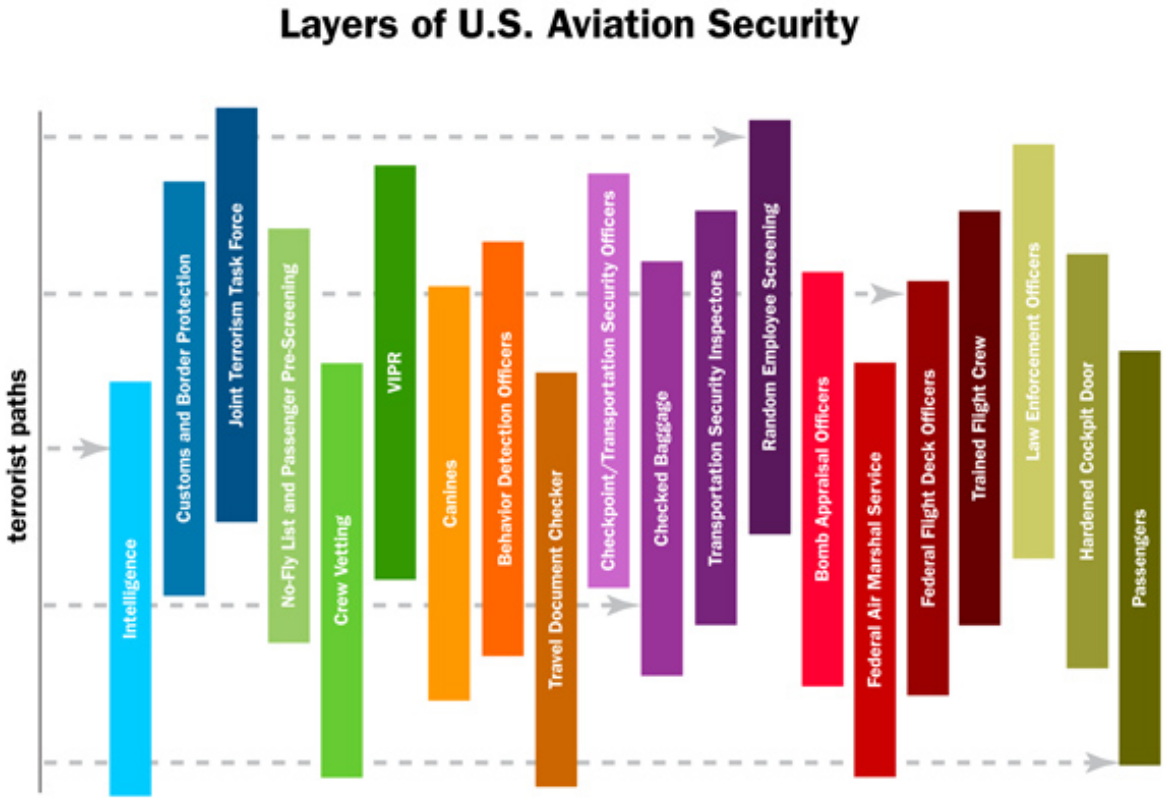

Figure 1. Layers of Airport Security (From TSA Website)

A similar multi-layered effort is being implemented on a worldwide scale by the United States and partner nations to intercept nuclear and radiological materials from misuse and apprehend those responsible. It is known as the Global Nuclear

[22] TSA website, http://www.tsa.gov/approach/layered_strategy.shtm.

Detection Architecture. The remainder of this thesis will primarily discuss domestic law enforcement options for participating in this effort.

The GNDA mirrors the TSA approach by instituting a number of layers, thus increasing the probability of detection and interdiction. It also serves as a deterrent to aspiring terrorists in that they have no idea how many detection layers they will encounter, or where they will encounter detection assets. In preventing radiological and nuclear terrorism, increasing the number of layers both internationally and domestically improves both the probability of detection/interdiction and strengthens the deterrent value by forcing an adversary to overestimate the chances of success based on random countermeasures embedded in the domestic layers. Law enforcement officers equipped with detection equipment can very well serve as the last layer in preventing a nuclear or radiological event.

b. The Global Nuclear Detection Architecture (GNDA)[23]

The current strategy for preventing the illegal movement and detection of unauthorized nuclear and radiological materials is known as the Global Nuclear Detection Architecture. This is a multi-layered approach to detecting and interdicting terrorists or materials attempting to enter the United States. Before defining the role of law enforcement in the GNDA, it is important to discuss its definition and overall objectivities. The GNDA is described as a "whole of government"[24] approach because it involves components from various entities, such as the Department of Homeland Security, including its Domestic Nuclear Detection Office (DNDO), and the Departments of Justice, State, Defense, and Energy.

The 2010 Domestic Nuclear Detection Office Strategic Plan defines the GNDA as:

> ... a worldwide network of sensors, telecommunications, and personnel, with the supporting information exchanges, programs, and protocols that

[23] Policy Documents concerning the GNDA are discussed in greater detail in the Literature Review.

[24] (White House, 2005).

> serve to detect, analyze, and report on nuclear and radiological materials that are out of regulatory control. The term "out of regulatory control" refers to materials that are being imported, possessed, stored, transported, developed, or used without authorization by the appropriate regulatory authority, either inadvertently or deliberately. [25]

There are four layers to the GNDA[26] consisting of:

- *Exterior layer, including foreign countries and USG international activities;*
- *Trans-border layer, including transit to the U.S. and the U.S. border;*
- *Interior layer, including the domestic U.S. but excluding the border; and*
- *Cross-cutting efforts, including activities that apply across or to all geographic layers.*

The first layer does not involve local level law enforcement agencies and is international in its focus. One example of this international layer is the Megaports initiative, "which aims to strengthen the capability of foreign governments to deter, detect, and interdict illicit trafficking in nuclear and other radioactive materials transiting the global maritime shipping system." The Megaports Initiative seeks to equip 100 seaports with radiation detection systems by 2015, scanning approximately 50 percent of global maritime containerized cargo."[27]

The second layer relates to ederal law enforcement agencies, including the Coast Guard and Customs, which monitor and secure our international borders. The TSA also plays a role in the GNDA because any airport that accepts international flights is part of our country's borders. The Coast Guard, Customs and Border Patrol, and TSA all deploy personnel with radiation detection equipment across land borders, seaports and commercial aviation pathways.

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[25] (White House, 2005), 6.

[26] Ibid., 7.

[27] (NNSA website).

The third layer concerns the interior security of the U.S. where local law enforcement agencies can provide a critical component to the GNDA. Other public safety agencies play a role in the interior including Fire and EMS Departments, as well as State Health and Radiation Control Programs. This discussion will focus on law enforcement as it is the discipline that can take interdiction actions after material is detected and while threat conditions exist.

Figure 2 shows the first three layers as described above.

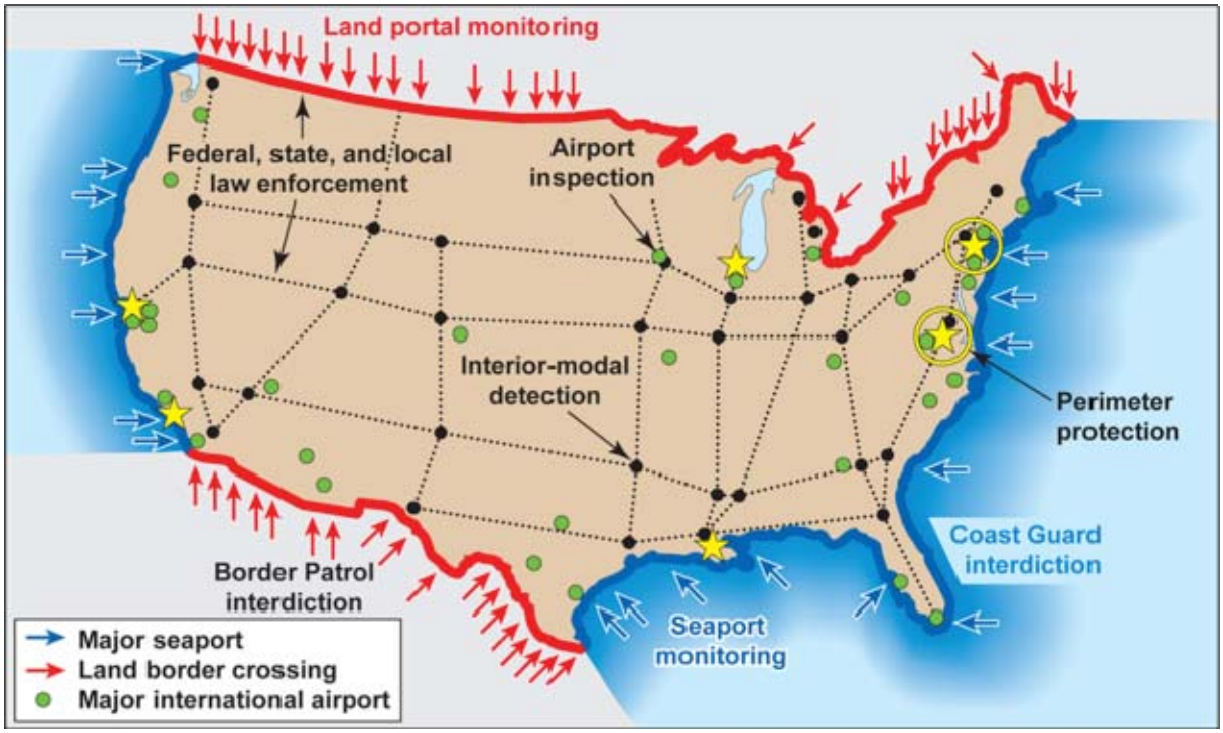

Figure 2. Domestic Portion of GNDA (May 2010 DNDO Briefing)

The final layer is designed to reinforce DNDO's mission to integrate these layers from separate international, border, and interior initiatives in a collaborative effort that supports all GNDA efforts.

The next section will examine the role law enforcement can play in the GNDA followed by relevant skills already possessed that will assist them in that new role.

c. Law Enforcement as the Domestic Portion of GNDA

The role of law enforcement is concentrated in the interior portion of the GNDA. Police are assigned throughout the nation in an ever-present deployment mode. The concept that can benefit the GNDA is that law enforcement officers are generally available twenty-four hours a day, every day and although rural areas may experience reduced response times, there is still a responsible jurisdiction for every geographic area. This gives a program like the GNDA a physical advantage by utilizing police that are on patrol. With additional training, equipment, and procedures related to the GNDA, police officers could seamlessly mesh their existing duties with counterterrorism, thus alleviating the expense of a dedicated detection personnel.

The largest single law enforcement program involved in the GNDA is the "Securing the Cities" (STC) Initiative based in New York City. The program provides detection equipment and training to law enforcement agencies in New York, New Jersey, and Connecticut. The 2011 Progress Report on 9/11 Recommendations states, "Through STC, nearly 11,000 personnel in the New York City region have been trained in preventive radiological and nuclear detection operations and nearly 6,000 pieces of radiological detection equipment have been deployed. In April 2011, DNDO and the New York Police Department sponsored a full-scale exercise for radiological and nuclear detection capabilities in the New York City region to assess the ability of STC partners to detect radiological and nuclear materials and deploy personnel, equipment and special units in accordance with established protocols and in response to threat-based intelligence."[28] In its 2012 budget proposal, DHS proposed expanding the Securing the Cities (STC) initiative, designed to enhance the nation's ability to detect and prevent a radiological or nuclear attack in the highest risk cities, to include additional urban areas while continuing to support efforts in New York.[29]

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[28] Implementing 9/11 Report Recommendations, July 2011, 32.

[29] Ibid., 32.

There are four broad mission categories for law enforcement agencies involved in Preventive Radiological Nuclear Detection Operations (PRND). [30] The four missions[31] are:

- Radiological Material and Site Protection / Response: Law enforcement can assist in the security of known locations where radiological and nuclear materials are stored or used.
- Steady State: 24/7 deployment of detection equipment by patrol personnel.
- Special Event / Enhanced Steady State: Adding PRND personnel to the security of special events from National Security Special Events to local venues.
- Surge / Intelligence Driven: Deploying PRND personnel based on threat information

Within each of the above are three common mission activities:

- Primary Screening: Making "first detection" or contact with a radioactive material. May be either innocent or illicit.
- Secondary Screening: Determine if the material detected is innocent or illicit in nature.
- Technical Reach-Back: Receiving assistance from federal authorities including the FBI and National Laboratories to make a final determination of the materials use or threat.

The following illustrates the existing skills and traits possessed by police officers, which supports an assertion that law enforcement can make a valuable contribution to the GNDA effort.

d. Relevant Law Enforcement Skill Set

Many disciplines including first responders (Fire and Emergency Medical Services), traditional radiation safety professionals, and the military have a role in the

[30] PRND is the term used by DNDO to describe the community of agencies, law enforcement and others, involved in the Domestic Interior portion of the GNDA.

[31] Additional information on PRND Missions, Activities and Equipment is contained in Appendix B.

Global Nuclear Detection Architecture (GNDA). Law enforcement officers possess skills that make their inclusion in Preventive Radiological Nuclear Detection (PRND) efforts desirable. These include:

Situational Awareness: No one is more familiar with his or her respective communities than the patrol officers responsible for its protection on a daily basis. These officers are trained, and in a position, to take notice when conditions change and/or detect suspicious behavior. They are naturally inquisitive to situations, persons, and other activities, which do not fit the usual patterns in a given area. This skill is developed and honed over the course of a career and is extremely difficult to duplicate with an individual encountering an area for the first time, particularly during an actual event.

Interview/Interrogation Skills: Police officers spend most of their time interacting with the public, e.g., criminal suspects, victims, witnesses, and the general population. They develop a sense of when a person is being truthful or deceptive. They make quick and efficient size-ups in the first few seconds of any interaction. This is a basic survival skill that like situational awareness is honed over the course of time and continues to improve and evolve.

Detention and Arrest Authority: Most nonlaw enforcement participants in the GNDA do not possess the statutory authority to stop, question, detain, and arrest individuals. This is a critical component when considering that the primary goal is not merely to find radioactive and nuclear material but to also stop individuals from using such product as a weapon. Any person can be trained to use instruments to locate these substances but having the legal ability to engage perpetrators without hesitation is fundamental.

Use of Force: It cannot be stated strongly enough that the goal of preventing radiological and nuclear terrorism is to identify and locate the persons responsible and recover all illicit materials being used. In the simplest terms, this means that is reasonable to assume that there will be persons present with the materials that will not willingly surrender it. As explained in the arrest/detention section, the ability to

actually stop the incident from occurring is the focus. This means being able to properly and effectively utilize physical force, including lethal force, a critical dimension that resides in the expertise of law enforcement.

This blending of acquired awareness, deception detection, conversation skills, arrest and detention powers, and lethal force capability is critical in the mission and function of PRND.

Some may argue that this is a national security issue requiring the sole attention of federal resources and that local agencies do not have the functionality, the budget, personnel, or other resources suited for these types of prevention activities.[32] An effective counter argument is presented, and the following section reviews the existing body of literature on threat existence and viability, the GNDA, and the expanded post-9/11 role of law enforcement to further sharpen this examination and strengthen support for expansion of current law enforcement efforts.

C. LITERATURE REVIEW

1. Introduction

This literature review establishes that the nuclear terrorism threat, albeit remote, does merit attention. It will also confirm that the GNDA was created to serve as a prevention system that encompasses a vast range of participation from the international to the domestic stages. This examination bolsters the proposal that the participation of local law enforcement as a function of the GNDA greatly relates to the greater homeland security enterprise and it worthy of study.

There are three parts to this review. Part One addressed the general threat of nuclear and radiological terrorism. Part Two discussed the GNDA and the lack of study concerning the GNDA's utilization of human capital (namely law enforcement) in the prevention of terrorism. Finally, Part Three explores the role of law enforcement in

[32] The arguments referenced are presented in greater detail below in the Literature Review.

homeland security, including the evolution of policing that encompasses a counterterrorism effort that is embedded in traditional crime prevention.

2. Nuclear and Radiological Terrorism

There is a wide and well-established body of knowledge in the area of CBRNE (Chemical, Biological, Radiological, Nuclear, and Explosives) Terrorism, including many sources citing the specific threat of the terrorist's use of radiological and nuclear weapons.

There are three primary arguments posed in the literature concerning Nuclear and Radiological Terrorism:

(1) **Exaggeration**: The threat of a terrorist's use of a nuclear or radiological weapon is overstated and that employing this type of weapon is beyond the capabilities of our adversary.

(2) **Concerns with Security of Threat Sensitive Material:** There are many sources for nuclear and radiological material that could be used for weapons throughout the world and security of such materials is a concern. This also includes the belief that as the number of nations that possess nuclear weapons increases, the possibility of diversion to a terrorist group also increases.

(3) **A Balanced or "Just in Case" Approach**: The risk of an attack using these types of weapons, although considered remote, would yield consequences so great that all efforts to mitigate their use are a worthwhile investment.

a. Exaggerated Threat

The reality of a successful nuclear or radiological attack on the United States undoubtedly will produce widespread ramifications, vast effects to include not only mass casualties, but a tremendous psychological impact on the entire population. To illustrate further, the previously discussed Los Angeles "Dirty Bomb" study looked at such effects to also include a $16 billion expense incurred by such an attack. There has been much public discussion and debate on the possibility of our most notable adversary, al Qaeda, having the means to accomplish a nuclear or radiological attack. In his book,

Will Terrorists Go Nuclear?, RAND's Brian Jenkins extensively analyzes this topic and refutes this possibility. In his July 2012 testimony before Congress, he made this salient point:

> Al Qaeda's central leadership clearly had nuclear ambitions and made an effort to acquire fissle material and technical expertise. However, there is no evidence that they acquired or even came close to acquiring nuclear weapons, and at some point in the last decade, the organization's nuclear weapons project turned from an acquisition effort to a propaganda program calculated to excite its followers and frighten its foes. [33]

This clearly shows that although there may be ambition, actual implementation is a much more complicated process. It is in Al Qaeda's interest for the world to believe they have access to these weapons but reality does not support that claim.

John Parachini also argues that there is little in the historical record in terms of successful attacks using CBRN weapons and that the terrorist's true interest may be exaggerated causing government resources to be misused to counter the perceived threat. His article, although making a good point for the need to balance efforts against the full spectrum of possibilities, does not specifically address the nuclear/radiological threat. It does, however, focus on the need for the United States to "strike a balance between preparing to address attacks with unconventional or CBRN weapons materials and conventional attacks."[34] This article supports the exaggeration position in that he suggests that the government has inflated the perception causing an imbalance in preventive measures that could be focused on more likely scenarios.

Many other sources contend that conventional explosives have been, and will continue to be, the terrorist's weapon of choice due to their availability and ease of use.[35] This argument was advanced at the July 2012 Senate Hearings on terrorism trends and tactics as cited by Brian Jenkins:

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[33] (Jenkins July 2012), 12–13.

[34] (Parachini 2003), 48.

[35] The National Counter Terrorism Center's Annual Terrorism Reports outline the statistics supporting this claim. The 2009 Report is used in the background material presented in Appendix A.

> Bombings have remained the most common mode of attack for all terrorist groups since the emergence of contemporary terrorism in the late1960's…the vehicle-borne devices have been seen mostly in foiled plots and FBI stings. [36]

A counterpoint to Parachini's article is the Harvard University Belfer Center report published in 2010 on Al Qaeda's attempts to acquire weapons of mass destruction. [37] The report chronicles AQ's efforts to obtain WMD materials needed to carry out such an attack. The report states that the group's "top priority has been to acquire nuclear and strategic biological weapons."[38] The author, Rolf Mowatt-Larssen, attributes their lack of success to "…a sustained and ferocious counterterrorist response to 9/11 that largely destroyed al Qaeda as the organization that existed before..."[39] His point being that Al Qaeda may still have the desire to acquire these weapons but lacks the means, adding support to Jenkins' position. Therefore, this body of literature holds that while the means to facilitate a nuclear or radiological attack are exaggerated, such an exaggeration results in misplaced or excessive preventive measures.

b. Security Concerns

The second primary argument in the literature is one that espouses that nuclear and radiological materials are present throughout the world and may be acquired in a variety of ways. These range from the theft of materials and construction of a device to the purchase of a completed weapon from a rogue nation. Numerous works supporting both pathways[40] were examined and the body of knowledge in this area is quite extensive supporting the premise of terrorist groups acquiring this type of weapon. An example

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[36] (Jenkins July 2012), 11–12.

[37] (Mowatt-Larssen, January 2010).

[38] Ibid., 5.

[39] Ibid., 7.

[40] Ferguson and Potter 2006 lay out both construction and purchase of nuclear material or complete weapon as part of their report for the Weapons of Mass Destruction Committee. The 2005 Literature Review conducted by Valsi for the Center for Risk and Economic Analysis of Terrorism Events has a survey of incidents of illicit material thefts and diversions.

found included testimony of Matthew Bunn before the United States Senate[41] and his Harvard University published report "Securing the Bomb."[42] In both publications, he provides historical examples of attempts to acquire weapons and weapons grade materials,[43] as well as discussing strategies to prevent these occurrences.[44] Concerns over radiological and nuclear material security support the concept that programs such as law enforcement involvement in the GNDA as part of its overall objective of preventing a terrorist organization from acquiring nuclear and radiological materials.

c. Prevention Efforts—Balanced Approach

The third argument describes the terrorist's use of a nuclear or radioactive weapon as a remote possibility but contains elements that efforts on prevention are worthy of our investment. Several examples were reviewed, while two underscored that the threat is real and the nation's enemies are interested in acquiring and using them. The first example is a joint United States and Russia threat assessment, which concludes:

> Nuclear terrorism is a real and urgent threat. Given the potentially catastrophic consequences, even a small probability of terrorists getting and detonating a nuclear bomb is enough to justify urgent action to reduce the risk. This study makes the case that it is plausible that a technically sophisticated group could make, deliver, and detonate a crude nuclear bomb if it could obtain sufficient fissile material.[45]

The report describes several scenarios that appear plausible but require a substantial effort resulting in a low, but not zero, probability of success. It does this by walking through a representative plot, the vulnerability analysis of security efforts, and device construction challenges.[46]

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[41] (Bunn, April 2008).

[42] (Bunn, April 2010).

[43] Ibid., 13.

[44] Ibid., 66.

[45] (Belfer Center, May 2011).

[46] Ibid., Ch. 5–6.

The report's conclusion, after observing the issues above, gives the following argument for the need to remove barriers to increased prevention and nonproliferation efforts:

> Although the international community has recognized the dangers of nuclear terrorism, it has yet to develop a comprehensive strategy to lower the risks of nuclear terrorism. Major barriers include complacency about the threat and the adequacy of existing nuclear security measures; secrecy that makes it difficult for states to share information and to cooperate; political disputes; competing priorities; lack of funds and technical expertise in some countries; bureaucratic obstacles; and the sheer difficulty of preventing a potentially small, hard-to-detect team of terrorists from acquiring a small, hard-to-detect chunk *of nuclear material with which to manufacture a crude bomb.*[47]

Documents, such as the Joint Assessment from the Belfer Center, support the protection of fissile material and subsequently reducing its illegal transfer and movement. These objectives are shown in the GNDA, and one could surmise that preventive costs spent in this endeavor are far less than the billions or trillions lost in an actual event.

The second example is the June 2011 National Strategy for Counterterrorism, which states, *"The danger of nuclear terrorism is the greatest threat to global security."* [48] This White House-produced document provides no justification for their claim and reads more as general counterterrorism rhetoric than as giving clear evidence to support its propositions. The alternative is that statements made therein are based upon classified intelligence information, which lies beyond the scope of this literature review.

Additional works dealing with the likelihood of an attack are Al Mauroni's 2012 article on nuclear terrorism published in Homeland Security Affairs and Muller and Stewart's "Terror, Security, and Money (2011)." Both are presented here because they

[47] (Belfer Center, May 2011) 14.

[48] (United States Government, July 2011).

are critical of the belief that nuclear or radiological terrorism is imminent, however, both contain elements supporting a cost effective preventive strategy as an option.

Mauroni begins with a statement similar to others:

> Despite the repeated warnings of a nuclear terrorist incident 'within the next three to five years' there have been in fact no nuclear incidents. There have been no reported 'loose nukes'. There have been no known attempts by a terrorist group to build a nuclear weapon. One of the reasons for this current state of affairs is that having the intent to become a nuclear-weapon-owning state is not the same thing as having the capability to build and use nuclear weapons.[49]

Mauroni later discusses, and is critical of the 'Securing the Cities' program, which is discussed later as policy option, and its financial implications, "*The theory is sound, but also costly, assuming the desire is to maintain this capability 24/7 throughout the year."* [50] This is similar to findings later in this thesis concerning the sustainability of such an effort. Mauroni concurs, "*Now there may be a more modest effort that could be sustainable.*"[51] This gives support to findings contained herein that a flexible cost series of options is most appropriate and program options can be scalable.

Mueller and Stewart seek in their work to apply a risk/reward type cost analysis to the entire post-9/11 homeland security effort. They argue that large sums of money have been expended with very little in tangible results or risk reduction. Their conclusion is simply, "*Given the quite limited hazard terrorism presents, enhanced expenditures designed to lower it have been excessive, sometimes massively so…the cost benefit ratio does not compute favorably."*[52]

They discuss a "dirty bomb" scenario in the port of Long Beach, California and an improvised nuclear device being detonated in New York City and present cost estimates of $1 trillion and $5 trillion in effects respectively[53] but estimate

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[49] (Mauroni, July 2012), 9.

[50] Ibid., 10.

[51] Ibid.

[52] (Mueller and Stewart 2011), 172.

[53] Ibid., 67.

the chances of success for this type of attack at best one in a million.[54] The remote possibility of this type of event is acknowledged. However, several cost options in a prevention effort, including those that have no additional direct cost to a law enforcement agency are recommended here as a worthwhile addition to traditional crime prevention. A statistical look at dollars spent and resulting risk reduction is well beyond the capability of this thesis, which seeks to support prevention efforts that strive to be reasonable and benefit all areas of terrorism prevention. This portion of the literature review has demonstrated that there is a threat of nuclear and radiological terrorism, although it will continue to be debated how large or imminent it may be.

The next section will look at the existing information on the Global Nuclear Detection Architecture including policy documents and corresponding criticism of its underlying technology.

3. Global Nuclear Detection Architecture

The next section of this review concerning the Global Nuclear Detection Architecture (GDNA) falls into two categories:

(1) Policy documents that outline the components, goals, objectives and implementation of the GNDA. These are mostly documents created by the United States Department of Homeland Security's Domestic Nuclear Detection Office (DHS-DNDO), which is charged under Presidential Homeland Security Directive 14 with managing the GNDA.

(2) Documents which are critical of the utility, progress, and outcomes of the GNDA to date. This includes several documents that point to projects in which millions of dollars where expended with little or no results. These failed efforts lie mostly in the United States Government's development of new sensor and detection technology.

[54] (Mueller and Stewart 2011), 217.

a. GNDA Foundation Documents

The first group described above relates to the creation and implementation of the Global Nuclear Detection Architecture including the DHS-DNDO 2010 Strategy Publication and the original Homeland Security Presidential Directive 14 from April 2005. Their inclusions demonstrate GNDA objectives and support an assertion that law enforcement can add value to the effort.

In April 2005, the White House released National Security Presidential Directive NSPD-43 / Homeland Security Presidential Directive HSPD-14 creating a Domestic Nuclear Detection Office (DNDO)[55]. DNDO is charged with the following:

> *(1) To protect against the unauthorized importation, possession, storage, transportation, development, or use of a nuclear explosive device, fissile material, or radiological material in the United States, and to protect against attack using such devices or materials against the people, territory, or interests of the United States, it is the policy of the United States to:*
>
> *(a) Continue to develop, deploy, and enhance national nuclear and radiological detection capabilities in an effort to better detect, report on, disrupt, and prevent attempts to import, possess, store, transport, develop, or use such devices and materials;*
>
> *(b) Continue to enhance the effective integration of nuclear and radiological detection capabilities across Federal, State, local, and tribal governments and the private sector for a managed, coordinated response; and*
>
> *(c) Continue to advance the science of nuclear and radiological detection through an aggressive, expedited, evolutionary, and transformational program of research and development in such detection technologies.*[56]

Emphasis was added to 1(b) above because it is the focus of this thesis concerning the role of law enforcement in the nation's strategy.

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[55] (White House 2005).

[56] Ibid.

The 2010 GNDA Strategic Plan begins with a quote from President Barrack Obama delivered in April 2009 in Prague, "We must ensure that terrorists never acquire a nuclear weapon. This is the most immediate and extreme threat to global security."[57] This statement shows the continued commitment from the Office of the President to maintain programs such as the GNDA to form a defense against Nuclear and Radiological Terrorism. Again, as was the case with the National Counterterrorism Strategy, there were no citations to support the President's statements. It does, however, frame the GNDA discussion as a program that has moved across administrations.

b. GNDA Criticism

The second group is a series of articles critical of the technology side of the GDNA. They collectively point out failures in the Advanced Spectroscopic Portal (ASP) Program. The ASP program is an effort to create new detection technology for use at our borders and seaports, which has suffered from budgetary and performance issues. A Congressional Research Service (CRS) document reviewed outlined options for Congress concerning the program including *"further scrutiny of DHS and oversight of the testing, certification, and procurement process."*[58]

A July 2011, Government Accountability Office (GAO) report was more direct in its criticism:

> DNDO's problems developing the ASP and CAARS technologies are examples of broader challenges DHS faces in developing and acquiring new technologies to meet homeland security needs. Earlier this month, we testified that DHS has experienced challenges managing its multibillion-dollar acquisition efforts, including implementing technologies that did not meet intended requirements and were not appropriately tested and evaluated, and has not consistently completed analysis of costs and benefits before technologies were implemented.[59]

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[57] (Department of Homeland Security 2010), 4.

[58] (Shea, Moteff, and Morgan, December 2010).

[59] (GAO July 2011), 4.

This argument also appears in Mueller and Stewart's work that is critical of the fact that the Nation as a whole has done little or no cost-benefit analysis in any homeland security program.

This review uncovered no literature of a professional, academic, or governmental nature that examined the human aspect of GNDA implementation or operations, including the use of local law enforcement agencies. It is imperative not to view technological failure as a rationale to discontinue GNDA operations or as a reason to dismiss the potential that law enforcement participation holds in GNDA. While vocal criticism of the GNDA exists, it is not a complete condemnation of the GNDA objectives in preventing nuclear and radiological terrorism.

4. Role of Law Enforcement in Homeland Security

Since September 11, 2001, there has been an evolution in law enforcement. Prior to that date, law enforcement was tasked as crime fighters and community problem solvers. In the post-9/11 world, all law enforcement agencies have a stake in protecting the homeland. Searching for literature in this transition of law enforcement led to several works supporting the evolution from crime fighter to terrorism preventer. In what can be seen as somewhat of a cliché, "crime prevention is terrorism prevention,"[60] lays the premise of what has taken place. Many of the same strategies used in countering traditional crime can be retooled and expanded for use in countering terrorism.

A Rutgers University dissertation by Michelle Grillo examined the post-9/11 transformation in twenty-one police departments nationwide and provided information on the new mission, duties, and structural changes that occurred. She notes, "local police agencies are now sharing responsibilities in the mission of preventing and detecting terrorist activities. The responsibilities to participate in terrorism investigations and respond to potential terrorism-related service calls have changed fundamentally the day-to-day functioning of local police."[61]

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[60] This theme has been used by the National Crime Prevention Council, www.ncpc.org.

[61] (Grillo, 2011).

The International Association of Chiefs of Police (IACP) stated in their 2001 terrorism report:

> No matter how the future unfolds, local law enforcement will be on the front lines. In democratic societies, an enormous degree of responsibility and authority for public security is historically delegated to the local government, particularly to police agencies.[62]

This concept was echoed by the Police Executive Research Forum (PERF) in a 2005 report on strategies for local law enforcement:

> Law enforcement agencies have historically been charged with preserving the safety and security of the public. Regrettably, this mission is no longer limited to traditional crime – the prevention and deterrence of another terrorist attack on American soil have become a crucial part of this mission.[63]

Any terrorism event that takes place domestically places law enforcement in the leadership role. Washington, DC Metropolitan Police Chief Cathy L. Lanier wrote in 2005:

> Today's terrorism is a local crime and with the potential for future attacks increasing, it is essential that we engage the more than 800,000 state, local and tribal police officers that work in our local communities in strategic prevention activities.[64]

Her observation focuses law enforcement on becoming a force multiplier, adding nearly a million first preventers to this new counterterrorism role. Chief Lanier and other experts affirm that local law enforcement has a duty in terrorism prevention and by extension that active participation in the GNDA is warranted.

The author of this thesis has previously written on the role of police in radiological material security[65] and formally addressed police executives of the IACP. Inspector Stuart Cameron, who assisted in thesis, has written on the integration his of

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[62] (IACP, 2001), 5.

[63] (PERF, 2005), 1.

[64] (Lanier, 2005).

[65] (Baldini, 2010).

department[66] in the GNDA as part of the "Securing the Cities" Initiative. However, a source search illustrates the full role of law enforcement in the GNDA is unexplored in any great depth. There were no sources located that advocated leaving homeland security or counterterrorism strictly to federal entities. This should lead a law enforcement agency to conclude that homeland security is truly "hometown" security and that all levels of government from federal to local play a valuable role in preventing the full spectrum of possible terrorism events.

5. Conclusions and Significance of Research

The threat of nuclear and radiological terrorism is, in this researcher's opinion, significant; and the potential consequences are great enough to warrant the examination of policy options by law enforcement to prevent these types of attacks in a cost effective manner. The pursuit of adding to this emerging portion of the homeland security enterprise body of knowledge is challenging but worthwhile.

The next section outlines a methodology that explores these policy options for law enforcement prevention programs supporting the GNDA.

D. DESIGN AND METHODOLOGY OF POLICY OPTIONS ANALYSIS FOR LAW ENFORCEMENT PRND PROGRAMS

1. The Path Forward

The previous sections have shown that nuclear and radiological terrorism is an international concern that requires a coordinated prevention effort as was implemented with the Global Nuclear Detection Architecture. It is argued that law enforcement brings value to the mission through enhancing its traditional crime prevention role and innate skill set to meet the need of increasing the domestic layer of the GNDA. By increasing the number of law enforcement agencies that participate in Preventive Radiological / Nuclear Detection programs, the domestic layer becomes more comprehensive and ensures that a true defense in depth model is achieved.

[66] (Cameron, 2010).

The next step is to examine the several possible paths for a law enforcement agency initiating a PRND program. This thesis author has been professionally involved with the PRND mission since 2005 and has participated in extensive DHS-DNDO programs concerning the domestic implementation of the GNDA. He has served as program manager for his employer, the Philadelphia Police Department, for their PRND efforts and works on a daily basis with other PRND program managers from across the country of every size and type. This research has examined several dozen PRND programs currently fielded domestically and identified four broad categories. These four categories will form the four policy option models presented in this thesis. Each of the four models uses an actual PRND program as a case study to further illustrate its comparative strengths and weaknesses. This analysis applies both quantitative and qualitative metrics to each of the four policy option models. The next section outlines these four program options.

2. Four Policy Option Models for Consideration

a. Sole Federal Responsibility

This represents no action on part of nonfederal law enforcement agencies. An agency, after reviewing the threat information, decides not to create a PRND program, due to actual or perceived barriers such as funding. Their conclusion is that the GNDA effort is not in the purview of local law enforcement and remains within the sphere of United States Government (USG) agencies in the national security arena.

b. Single Law Enforcement Agency Program

This is a program that includes only the originating law enforcement agency. This is the first step in a progressive program that begins with training and equipping a limited number of personnel.

c. Multi-Agency Law Enforcement Program

This involves the originating agency and surrounding law enforcement entities working in a cooperative program to provide wider prevention coverage. An example would be multiple police departments working together in an Urban Area Security Initiative (UASI) region.

d. Multi-Discipline/Multi-Agency PRND Program

This requires a number of agencies from several geographic jurisdictions and from one or more additional public safety agencies such as Fire, EMS, Public Health, as well as State and Private Sector Radiological Professionals. This program option combines the inherent strengths of law enforcement in counterterrorism programs with the technical expertise and response capabilities of other first responders.

3. PRND Policy Option Analysis Through Existing Examination of Represented Case Studies

a. Case Study Selection Process

Four existing Preventive / Nuclear Detection (PRND) programs will be examined[67] as case studies in this policy options analysis.

The Transportation Security Administration (TSA) Visible Intermodal Prevention and Response (VIPR) Teams will be used as an example of the "no action of part of nonfederal law enforcement." This assumes that a jurisdiction has examined the radiological / nuclear threat and determined that its prevention is a responsibility of federal agencies. The TSA VIPR program exemplifies a federal PRND operation concentrated on surface transportation that blends intelligence-driven, steady state, and special event coverage.[68]

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[67] The example programs were selected by the Researcher based on first hand participation and evaluation of said programs, access to program information, as well as time and financial constraints of the research process.

[68] See Appendix B for a detailed description of intelligence-driven, steady state, and special event missions

For the single agency example, the Los Angeles County Sheriff Department's PRND program will be used. This is a robust, county-level, steady-state program in one of the nation's largest metropolitan areas that incorporates a strong maritime presence in the ports of Los Angeles and Long Beach, California.

The Philadelphia Urban Area Security Initiative (UASI) Law Enforcement PRND program will serve as the example for Multiple Agency/Jurisdiction—Single Discipline option. It includes a major city department, a number of smaller suburban departments, and a major university police force.

The New York City centered program known as "Securing the Cities," which comprises three states and over 200 agencies under the coordination of thirteen principal partners, will serve as the last model presented—Multiple Agency/Discipline/State option. Here, law enforcement at the city, county, and state level from New York, New Jersey, and Connecticut work with fire service, health department, and radiation safety professionals to form the largest single PRND program in the nation.

b. Cost Analysis

For each policy option presented, there will be a cost estimate for initiation and sustainment. There is a cost figure attached to each piece of equipment and its related maintenance; as well as personnel costs for training and exercises.

c. Comparison to National Incident Management System (NIMS) Resource Typing Criteria for Preventive Radiological / Nuclear Detection (PRND)

Fully contained in Appendix C of this document is the June 2011 final version of the Typed Resource Definitions for Preventive Radiological / Nuclear Detection Resources. It covers typing of both a PRND team (several models) and categories of PRND-specific equipment.

The Domestic Nuclear Detection Office of the Department of Homeland Security describes the purpose of the document as follows:[69]

Purpose:

PRND NIMS Resource Typing categorizes the PRND teams, equipment, and personnel employed by federal, state, local, and tribal entities to conduct the PRND mission and enhance the sharing and integration of these PRND resources across jurisdictions.

Benefits:

By providing a common categorization of PRND resources, the PRND NIMS Resource Type Definitions directly support state, local, and tribal jurisdictions' PRND planning and operations.

- Facilitates the creation state, local, and tribal PRND programs

- Assists jurisdictions to categorize current and future PRND resources

- Provides common building blocks for state, local, and tribal jurisdictions when estimating capability needs while using the PRND Capability Development Framework

- Increases the speed and effectiveness of interstate mutual aid requests through the Emergency Management Assistance Compact (EMAC) and other resource management mechanisms

The Domestic Nuclear Detection (DNDO) coordinated the PRND NIMS Resource Type Definitions development, in partnership with federal, state, and local subject matter experts.

Agencies should strongly consider using the equipment and team descriptions contained in the PRND NIMS document as future homeland security grant funding will likely be tied to compliance of this standard.

d. Qualitative Factors

(1) Political Acceptance. Each of the four program options is examined respective of political acceptance. One consideration being—have they been

[69] DHS-DNDO Fact Sheet: PRND NIMS Resource Type Definitions.

viewed in a positive manner and recognized as being an appropriate homeland security counter measure in their respective areas? In the case of the NYC region "Securing the Cities" program, it has been saved from funding elimination based largely on its political acceptance.

(2) Program Flexibility / Sustainability. Finally, each program is examined to predict if its size and structure based on NIMS typing and Capability Framework Development levels can be funded in the current environment of reduced homeland security grant funding. The test of these programs is if they will survive if the outside funding is removed or would they have to be scaled back or eliminated.

e. Conclusion

As stated earlier, existing PRND programs are used in the next section as case studies for each option to further demonstrate the features. Each program will be shown as a model with the following attributes, referred to as POETE/Ops delineated for each:[70]

1. Planning
2. Organization
3. Equipment
4. Training
5. Exercises
6. Operations Support

Chapter IV has a matrix depicting the relative strengths and weaknesses of each option. Assessment criteria include NIMS typing, training costs, equipment and sustainment costs, and an overall program ranking. The final program scoring is scaled in the form of Limited, Good, Better, Best formatting and includes text descriptions to support the ranking assigned.

[70] These six POETE/Ops aspects are taken from DHS-DNDO PRND Program Management Handbook to serve as a reference frame for the modeling of case study examples. This author actively participated in the Handbooks creation.

III. PREVENTIVE RADIOLOGICAL/NUCLEAR DETECTION POLICY OPTION MODELS PRESENTED WITH SUPPORTING CASE STUDIES

A. MODEL DESCRIPTION INTRODUCTION

The previous chapter proposed a role for law enforcement as part of the Global Nuclear Detection Architecture (GNDA) and how law enforcement's unique blend of traditional crime prevention adds value domestically to an international preventive strategy.

This chapter will present four policy option models and outline six program aspects that will be used later for analysis.

Each PRND policy model presented here will begin with an overview and then proceed through six POETE/Ops factors taken from the DHS-DNDO Program Management Handbook:

1. **Planning**- Develop a program strategy, begin and manage a PRND Program.[71]

2. **Organization**- Organizational Design, Stakeholder Engagement, and Staffing a PRND Program.[72]

3. **Equipment**- Selection, Acquisition, and Maintenance.[73]

4. **Training**- Develop, Establish, and Manage program Training. [74]

5. **Exercises**- Develop, Establish, and Manage program Exercises.[75]

6. **Operations Support**- Technical Reachback and Information Sharing Support including from federal assets.[76]

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[71] (DHS-DNDO Program Handbook), Planning 1.

[72] Ibid., Organization 1.

[73] Ibid., Equipment 1.

[74] Ibid., Training 1.

[75] Ibid., Exercises 1.

[76] Ibid.,. Operations Support 1.

B. PRND POLICY OPTION MODELS

1. Option A: PRND is a Federal Law Enforcement Responsibility

a. No Local Action

A law enforcement agency may take the position that the prevention of radiological and nuclear terrorism is well outside their area of responsibility. This is the general default position of the vast majority of agencies in the nation.[77] It may be an issue of not being aware that such a threat exists, a lack of exposure to GNDA and its components, or simply a budgetary or personnel restraint. Agencies may view this type of homeland security mission residing more in the realm of national security and squarely the purview of federal law enforcements or even the military. Another perspective may be that radiation and radiological / nuclear materials are hazardous materials, not law enforcement's responsibility but that of the Fire Service or established State Radiation Safety agencies.

There are a number of federal agencies that are active in the prevention of this type of terrorism and deploy personnel and equipment as part of the federal domestic component of the GNDA. The Federal Bureau of Investigation, Customs and Border Patrol, Coast Guard, National Guard Civil Support Teams, and the Departments of Energy and Homeland Security have active PRND programs that provide limited coverage of our ports, borders, airports, and "as warranted" coverage in some metropolitan areas.[78] The analysis of this model in Chapter IV will focus on the Transportation Security Administration (TSA) Visible Intermodal Prevention and Response (VIPR) program as it is structured in the Philadelphia, Pennsylvania Field Office for demonstration purposes.[79]

The model attributes below are viewed from an outside law enforcement agency without its own PRND program interacting with this federally based program.

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[77] There are currently many more Law Enforcement agencies without a PRND Program than with one.

[78] DHS-DNDO website. Operations Support Directorate Page. www.dhs.gov/xabout/structure/.

[79] VIPR selected by due to history of Joint Operations/Training with Philadelphia Police PRND Program.

Due to the fact that this option model is external to a law enforcement agency considering a program, this unique reverse view approach is needed for this option's analysis alone. The TSA program, along with other federal programs, has agency specific operations that lie outside the scope of this thesis.

b. Model Attributes

(1) Planning. A local law enforcement agency without its own PRND program would ideally plan on how to integrate federal assets, such as TSA's VIPR, into its existing operations in this model. A formal plan may exist in this model for federal assets to conduct the PRND mission although it is unlikely since the agency may not be aware of the PRND mission, equipment, or capabilities associated with radiological / nuclear terrorism prevention. Law enforcement, without their own dedicated PRND program, should plan for the involvement of federal assets under this model.

(2) Organization. The federal PRND model will be a small team framework and will require logistical assistance from local law enforcement agencies to carry out most missions beyond preventive patrol. Law enforcement, without their own dedicated PRND program, should prepare for joint deployment of personnel with federal assets under this model.

(3) Equipment. Equipment in the federal model will run from basic detection gear through advanced isotope identification capabilities. Using the NIMS typing contained in Appendix C of this document; the TSA VIPR team meets the capability of a Type 3 NIMS PRND Team while specialized teams from the Department of Energy would exceed the Type 1 classification.[80] Law enforcement, without their own dedicated PRND program, should understand the equipment capabilities of the nearest federal assets under this model.

(4) Training. Training under this model will usually take place at the national level without participation of the non-PRND law enforcement agencies in the

[80] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety

area of the federal team. The training is likely to occur at centralized locations and not in the federal teams geographic area of assignment. However, if local agencies are invited to participate, they would be well served to do so.

(5) Exercises. Exercises conducted under this model will usually take place at the national level without participation of the non-PRND law enforcement agencies in the area of the federal team. However, if local agencies are invited to participate, they would be well served to do so.

(6) Operations Support. Federal PRND assets will always use federal technical reach-back and alarm adjudication through one of the National Laboratories. This is not the case in all of the succeeding models. Law enforcement agencies should also understand that if they call upon federal PRND assets, the local FBI field office and DHS will be notified of their operations.

This concludes the PRND option model where the local law enforcement agency is a nonparticipant and likely is the client of the federal team deployed. This "no local action" model was cumbersome to adapt to the POETE/Ops framework but the remaining three models, where local participation exists, more suitably fit this framework.

The next policy option model is a law enforcement agency adopting a single agency approach to the POETE/Ops framework.

2. Single Agency Law Enforcement PRND Program Option

a. Embarking Alone

A law enforcement agency may determine that it is in their best interest to begin a locally-based PRND Program. Often, this may be a first step in a program's progression. Examples will be presented in subsequent sections of this thesis in cases of Philadelphia and New York. The agency trains and purchases detection equipment and chooses to implement one or more of the PRND mission areas covered earlier—Steady State, Enhanced Steady State/Special, and/or Intelligence/Threat driven search operations. In the following example, a large agency responsible for a diverse population

of urban and suburban subdivisions is used as the model case study to analyze this policy option.

b. Model Attributes

(1) Planning. A local law enforcement agency with its own PRND program initially plans how to equip, train, and provide exercises to its own members in one or more of the relevant missions: Material Protection and Response, Steady State, Intelligence Driven, and/or Enhanced Steady State/Special Event coverage. Standard operating procedures are developed to guide the department's personnel in each of the mission areas that apply. If local PRND capabilities are limited, the jurisdiction's planning should include partnering with federal programs or other applicable responding agencies as needed to close the gaps.

(2) Organization. A single agency PRND program is organized along departmental lines like any other unit or program in the respective agency. A clear chain of command will dictate how radiological and nuclear incidents are handled and when responsibility is transferred to another entity, such as the FBI.

(3) Equipment. Single agency PRND programs seek equipment relative to the missions it intends on conducting. If choosing to conduct the full spectrum of PRND activities it will need to have organic, or in-house, equipment to provide these capabilities. This extends to aviation and marine detection equipment if appropriate to the jurisdiction.

(4) Training. Training under this model typically uses federally sponsored PRND courses taught through a jurisdiction's request to DHS. Many programs also us "train-the-trainer" opportunities which allow for their agency to conduct the same courses "in-house" leading to savings in areas such as personnel costs.

(5) Exercises. Exercises conducted under this model normally begin internally to ensure that departmental policies are being followed. As experience increases, involving other response partners for collaboration in complex scenarios may follow.

(6) Operations Support. There are only two options for operations support for nonfederal PRND programs of all types. The most common is the use of federal assets such as DNDO's Joint Analysis Center (JAC) in Washington, DC or one of the National Laboratories directly. The second option is using the respective State Radiological Agency for technical reach back and alarm adjudication. All programs shown herein as case studies use the JAC. The State of Illinois PRND program[81] is an example of a state-based operations support mechanism that does not use the JAC.

This concludes the PRND option model for a single law enforcement agency to use as its own organic PRND program. The next policy option model is for a law enforcement agency choosing a collaborative, regional approach with several other law enforcement agencies applying the POETE/Ops framework.

3. Multi Agency Law Enforcement PRND Program Option

a. Working with Law Enforcement Peers

Another option for law enforcement agencies is to engage partners in order to pool resources, such as equipment and training, or to collaborate with other response organizations, such as Fire Departments or traditional radiation safety professionals in the public or private sector. This option can also be viewed as the next step in a progression to the final option presented in the next section. A multi-jurisdiction/agency approach can provide a means to provide some PRND capability over a wider area and allow for joint operations to increase capabilities not possessed by each individual agency leading to a cost savings on training, equipment and related activities.

b. Model Attributes

(1) Planning. In the multi-agency program, all planning activities are conducted jointly with the other members. If there is one dominant agency, the others may choose to follow that department's existing program and make needed changes caused by expansion of the program. For example, the Philadelphia Police Department's

[81] Author has professional experience with Illinois' PRND and is familiar with its unique reach-back capabilities.

PRND program became the UASI PRND program through an expansion process in the region. Planning efforts began in the City and were enhanced as new members entered the program.

(2) Organization. As with planning, organization in the multi-agency model will be collaborative in nature with standing policies and procedures for joint operations among the partner member agencies. The limiting factor is that it still is a model composed of primarily law enforcement and is not multi-discipline as shown in the final option.

(3) Equipment. Multi-agency PRND programs seek equipment relative to the missions it intends to conduct. If choosing to conduct the full spectrum of PRND activities, it needs to have organic, or in-house, equipment to provide these capabilities. This extends to aviation and marine detection equipment if appropriate to the jurisdiction. The advantage to multi-agency programs is that equipment can be spread across the various partners and used by all on an "as needed" basis. This allows for avoiding equipment duplication by all member agencies resulting in a cost savings.

(4) Training. Training under this model usually take uses federally sponsored PRND courses taught at a jurisdiction's request to DHS. Many programs employ "train-the-trainer" opportunities which then allows their agency to conduct the same courses "in-house" leading to savings in areas such as personnel costs. Due to the multi-agency aspect of this model, officers from each department are trained together to further instill the joint operations stressed in its design.

(5) Exercises. Exercises conducted under this model are multi-agency in scope in order to stress the partnering aspect of the model. The limiting factor is that they include only the partner agencies and would benefit from the participation of other disciplines.

(6) Operations Support. There are only two options for operations support for nonfederal PRND programs of all types. The most likely is the use of federal assets such as the JAC in Washington, DC or one of the National Laboratories directly. The second option allows for the use of a State Radiological Agency for operations support previously discussed.

This concludes the multi-agency law enforcement PRND program model. Next is the final policy option model, a multi-agency and multi-discipline program that covers multiple states.

4. Multi-Discipline/Multi-Agency PRND Program

a. Working with all Response Partners

In this option, a large geographic area encompassing several states and political subdivisions of every size and type work across disciplinary lines to achieve a true defense in depth approach to PRND. The challenges here involve the need for a large source of continued funding as well as a standing organization to manage the program ensuring unity of effort and consistency for training and equipment as well as a common set of operating procedures. Although this type of effort may be daunting to attempt, the benefits of this type of program include the ability to provide cost effective coverage across a region. In the later example, the greater New York City area is shown, an obvious potential terrorism target, and Suffolk County, New York is shown as a representative principle partner.

b. Model Attributes

(1) Planning. In the multi-discipline/multi-agency program model, all planning is done through formal committees with representation by all principal partners. This ensures the most thorough level of planning respective of each partner's unique skill set and needs relative to the Preventive Radiological / Nuclear Detection effort. It is the most comprehensive planning model of all the options presented.

(2) Organization. This model utilizes a formal committee organization with an executive board and subordinate groups focusing on all aspects of program management and delivery with input from all partner agencies. Due to its multi-discipline design, this is the most comprehensive organizational model presented.

(3) Equipment. Multi-discipline PRND programs seek equipment relative to the missions it intends to conduct. If choosing to perform the full spectrum of PRND activities it will need to have organic, or in-house, equipment to provide these

capabilities. This extends to aviation and marine detection equipment if appropriate to the jurisdiction. The advantage to multi-discipline programs, as was seen with the multi-agency program previously, is that equipment can be spread across the various partners and used by all on an "as needed" basis. This allows for avoiding equipment duplication by all member disciplines resulting in a cost savings.

(4) Training. Training under this model often uses federally sponsored PRND courses taught at a lead jurisdiction's request to DHS. Many programs employ "train-the-trainer" opportunities which allows for their multi-disciplinary program to conduct the same courses "in-house" leading to savings in areas such as personnel costs. Due to the inter-disciplinary nature of this model, responders are trained together to further instill the joint operations stressed in its design and foster an appreciation for the skills each discipline contributes to the program.

(5) Exercises. Exercises conducted under this model will be multi-disciplinary in scope in order to stress the partnering aspect of the model of responders from police, fire, public health, and traditional radiological professionals. This overcomes the limiting factor is seen in the previous multi-agency law enforcement-centric program model.

(6) Operations Support. There are only two options for operations support for nonfederal PRND programs of all types. The most common is the use of federal assets, such as the JAC in Washington, DC, or one of the National Laboratories. The second option is to use the respective State Radiological Agency for technical reach back and alarm adjudication. In the multi-discipline model, the State Radiological Agency may itself be a principle partner making this an beneficial option.

This concludes the program model descriptions that will be used in Chapter IV for analysis using case study examples. The following section discusses organizations that all law enforcement based programs should interact with on an "as needed basis" or by formal inclusion in their respective programs.

C. COLLABORATION OPTIONS BEYOND LAW ENFORCEMENT

1. Traditional Federal/State/Local Radiological Safety Agency Professionals

Law enforcement agencies beginning a PRND program can benefit by interacting with the more traditional radiological safety professionals at every level of government. These include the Department of Energy at the federal level, the state office of radiation protection and safety, and perhaps the local health department, which may have some responsibilities in this area. An agency may choose to partner with these agencies as a formal component. The NIMS Typing document in Appendix C includes multi-disciplinary PRND teams. The major shortcoming to nonlaw enforcement participants is they tend to lack the skill set discussed in the earlier section outlining the efficacy of law enforcement, e.g., arrest, detention, use of force and investigative competencies. All PRND programs benefit from positive interaction with this community in the form of secondary screening and technical reach-back.

2. Fire Service / HAZMAT

Similar to traditional radiation safety professionals, the Fire Service provides a wealth of assistance handling radiological and nuclear events through its traditional hazardous materials capabilities. These will be critical in the post-detection phase or during the aftermath of an attack. The Fire Service lacks arrest, detention, use of force authority and can be employed best in joint teams staffed with law enforcement officers. Fire Service professionals can also be of assistance in secondary screening and technical reach-back operations.

3. Military

Law enforcement-based PRND programs also partner with military assets at some special event and/or intelligence driven search operations. These will likely be Civil Support Teams (CST) from the state National Guard Bureau. CSTs are typically 20–25 National Guard personnel that are equipped with Personal Radiation Detectors (PRDs), Radiological Isotope Identification Devices (RIIDs), and Radiation Detection

Backpacks.[82] They can serve as force multipliers to handle large venues such as sports stadiums, or outdoor events such as parades. As seen in previous groups, they lack the arrest, detention, use of force, authority of law enforcement and are best deployed in joint teams as described in Appendix C, NIMS Typing.

4. Private Sector Radiological Professionals

An often-overlooked group is the private sector, which includes the radiation safety officers from hospitals, universities, and industries that use radiological materials in their daily course of business. Programs such as the Global Threat Reduction Initiative (GTRI), which seeks to voluntarily increase radioactive material security at civilian sites, such as hospitals and universities, provide a pathway to establishing a relationship with these stakeholders. A law enforcement agency would be greatly served by having an existing relationship with its radioactive materials license holders before a theft or other incident occurs at their site. Random visits by patrol personnel to these sites are another layer in the "defense in depth" strategy of the GNDA. These organizations can also be of great service in terms of training, and support in the form of instrument calibration and maintenance. Their experience with these types of instruments and their expertise cannot be overstated. The Philadelphia Police Department's PRND program, described later, has benefited immensely from partnering with the Environmental and Radiation Health professionals at the University of Pennsylvania. They have assisted as training instructors, participated in numerous drills and exercises, and provided their radioactive sources as aids to enhance the overall effectiveness of Philadelphia's program.

D. CONCLUSION

In this section, four policy model options have been presented as frameworks for law enforcement PRND programs. The models were shown to highlight the similarities and differences regarding POETE-Ops structure. By defining each model in this way, it assists policy makers in choosing the program type that meets their jurisdictional needs

[82] Equipment such as PRDs, RIIDS, and Radiation Backpacks are discussed more thoroughly in Appendix B.

and financial constraints. The next chapter analyzes each of the four program models using an existing law enforcement PRND program case study with regards to:

1. Cost Analysis: including training, equipment, and sustainment costs
2. NIMS Typing Analysis, by type definition
3. Program Evaluation including POETE-Ops (Limited, Good, Better, Best)
4. Final Program Ranking (Limited, Good, Better, Best)

IV. POLICY OPTION ANALYSIS

The previous chapters have introduced the background and justification for law enforcement's entry into the GNDA's domestic layer, as well as outlining four decision options concerning implementing Preventive Radiological Nuclear Detection efforts. This chapter will expand upon those options and compare the criteria introduced in the methodology section to allow agency managers to choose a program that meets their needs and budgetary restrictions.

A. NO LOCAL ACTION—FEDERAL PRND PROGRAM EXAMPLE

1. Program Overview—TSA Visible Intermodal Prevention and Response

In the wake of the September 11, 2001 attacks, the Transportation Security Administration (TSA) was created to increase aviation security for commercial passenger air travel. The most visible portion of TSA are the screening operations conducted by uniformed employees at every airport in the nation. Another aspect of a TSA layered security program is the Federal Air Marshall (FAM) deployment of plainclothes officers on random flights to act as a deterrent to highjacking and other terrorism related events onboard some domestic and international flights. The Visible Intermodal Prevention and Response (VIPR) program is the deployment of FAMs to surface transportation venues such as passenger rail, mass transit, and commercial vehicle enforcement. These are federal law enforcement officers that act in uniform, as opposed to the traditional undercover role of FAMs, and can be deployed in response to an increased threat or in a general deterrent posture in AMTRAK facilities, bus depots and other mass transit stations. The Domestic Nuclear Detection Office (DNDO) has provided training and PRND equipment to VIPR to "provide a greater federal detection capability and add an additional layer of RN detector-equipped law enforcement personnel in support of the GNDA."[83]

[83] Testimony of Acting DNDO Director Charles R. Galloway, U.S. House Appropriations Committee Subcommittee on Homeland Security, April 1, 2009.

The Philadelphia TSA Field Office currently deploys a VIPR team of approximately ten federal Air Marshalls that are rotated from their flying duties to surface transportation for a fixed period of time (less than one year). They are trained and equipped with PRDs, RIIDs, and Radiation Detection Backpacks to conduct these activities. They interact routinely with the Philadelphia UASI PRND program detailed later in this document.

The succeeding sections will evaluate the model's costs, its respective designation under the PRND NIMS Typing,[84] qualitative factors, POETE-Ops program evaluation, and a respective ranking compared to the other three program models presented.

2. Cost Analysis

The below cost analysis, using the normalized figures presented on Appendix B of this document are an approximation for the PRND capability of the Philadelphia Field Office for ten members of the VIPR. Actual costs may vary from region to region and this is best used as a planning factor for agencies considering starting a PRND program of this size and scope.

Ten Person TSA VIPR TEAM:

Equipment:	10 PRDs	@	$1,000 each	$10,000
	2 RIIDs	@	$20,000 each	$40,000
	2 Backpacks	@	$45,000 each	$90,000
Training:	10 personnel for 5 days of PRND training ($500 per person per day for 5 days)			$25,000
			TOTAL	$165,000

Equipment sustainment costs are approximately $4,000 per year.[85]

[84] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety.

[85] Appendix B gives initial and sustainment cost breakdowns for equipment and training for PRND activities.

3. NIMS Typing Analysis

Referring to Appendix C of this document, TSA VIPR Philadelphia represents a NIMS Type III Law Enforcement PRND Team. The definition of Type III is that of "Human Portable wide area detection and isotope identification." The primary separation point from Type IV to Type III is the use of Radiation Detection Backpacks for wide area searches. The cost analysis of $165,000 would represent any jurisdiction's baseline to establish a Type III team. For a comparison, the deletion of the backpacks would save $90,000 and reduce training by one day resulting in a NIMS Type IV LE team.

4. Analysis of Qualitative Factors

The political acceptance factor here is twofold. One position may be that there is someone performing the PRND mission in the jurisdiction thereby relieving the local law enforcement agency of the responsibility. The other may be that the federal officers are not part of the community, do not possess situational awareness, and not integrated in an overall local homeland security and crime prevention strategy. These factors will need to be gauged on a case by case basis by respective jurisdictions. The TSA VIPR teams can provide solid coverage, if integrated into special event, or intelligence-based search operations by a local jurisdiction.

The relatively low cost of the program both in terms of start-up and sustainability appear favorable for its sustainability in a tightening budgetary environment. The fact that it is a Type III team lends favorably to its expandability to Type II, or I if more funding becomes available.

5. Program Evaluation

a. **Planning—**Is federal centric and follows a national model. Local law enforcement would conform to their policy as opposed to a local protocol. Local input to this deployment is minimal leading to a rating of ***LIMITED*****.**

b. **Organization—**As with planning, organization follows a national model with minimal room for customization. This again leads to a rating of ***LIMITED*** due to lack of input from a local agency.

c. **Equipment—**Equipment purchasing for federal PRND programs is centralized within the respective agency and may not always fit unique jurisdictional challenges. For that reason, a rating of ***LIMITED*** is given. The local agency will be restricted to the equipment that the respective federal programs deploy in their area.

d. **Training—**Training in federal PRND programs is again centralized and standard throughout the respective agency and may or may not involve local law enforcement agencies. This results in a rating of ***LIMITED.***

e. **Exercises—**PRND related exercise program in federal programs are again centralized and standard throughout the respective agency and may or may not involve local law enforcement agencies. This results in a rating of ***LIMITED.***

f. **Operations Support—**Federal PRND programs will always utilize operations support from the Joint Analysis Center run by DNDO in Washington, DC or directly with one of the National Laboratories. This results in comprehensive analysis and earns a rating ***BEST***.

This program option analysis can serve as a model for a law enforcement agency that wishes to create a small, special event or intelligence based search PRND program for under $200,000. It represents real capability in the PRND mission space at a reasonable cost and can serve as a foundation for a stepped approach to increased capability. It shows that a small team, in this case ten operators, can provide substantial coverage to enhance special event security and also work with other agencies such as with the FBI in a threat-based search scenario. Its major limiting factor is that because it consists of only ten operators, long term or wide area operations will be difficult to sustain without assistance.

6. Option Analysis Summary

Table 3 gives a cost summary and rates the interoperability and expandability of the No Local Action program, especially if used as a baseline for creating a similar local law enforcement program. The final evaluation rating of ***LIMITED*** is based upon this program being a federal program that may or may not have a relationship with all local law enforcement agencies in their respective area of responsibility.

Table 3. TSA VIPR PRND Summary

NIMS Type	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
3	**$140,000**	**$25,000**	**$4,000**	**YES**	**YES**	**LIMITED**

The TSA VIPR program's major disadvantage is that its members are rotated on a regular basis and may not achieve the jurisdictional situational awareness mentioned earlier as an advantage for law enforcement agencies involvement in the GNDA.

The next program model analyzed is a single law enforcement agency creating their own PRND program.

B. EMBARKING ALONE—SINGLE AGENCY PRND PROGRAM

1. Program Overview—Los Angeles County Sheriff's PRND Program[86]

Los Angeles County covers 4,084 square miles and contains 88 incorporated cities. The Los Angeles County Sheriff's Department (LASD) provides contracted law enforcement services for 42 cities and all unincorporated areas through twenty-three patrol stations. LASD also provides law enforcement services for community colleges, county parks, hospitals, all rail and bus operations within the county, as well as jail security and court bailiffs. LASD has approximately 10,000 sworn deputies and an additional 8,000 support staff making it the largest sheriff's department in the world. The department has an aviation capability with twenty-one helicopters and marine operations with eight patrol boats. The department runs the largest jail operation in the free world with an average daily inmate population of approximately 20,000.

In 2004, the department received grant funding to begin a Preventive Radiation / Nuclear Detection (PRND) program. The department purchased 455 Personal Radiation Detectors (PRDs) for interdiction operations. The department also purchased survey meters and two Radiological Isotope Identification Devices (RIIDs) for this mission. In

[86] Information provided by Sergeant Michael Kelleher, Los Angeles County Sheriff's Department PRND Program Manager. Sergeant Kelleher and the author have worked collectively on PRND issues since 2007 as part of the author's position as Philadelphia Police Department PRND Program Manager.

2005, 405 radiation pagers were deployed to patrol stations with an additional 50 held for surge operations. A policy was crafted for patrol officers to carry out a steady state 24/7 mission and a HazMat Detail to conduct secondary screenings.

As funding increased, and in addition to steady state patrol the LASD PRND program added additional aviation and marine PRND capabilities, as well as conducted operations at special events. Currently, LASD has the capability to field one Type I and two Type II Law Enforcement PRND Teams.[87] The department can field five Maritime Law Enforcement PRND teams and currently has the ability to field three airborne mobile systems.

The succeeding sections will evaluate the model's costs, its respective designation under the PRND NIMS Typing,[88] qualitative factors, POETE-Ops program evaluation, and a respective ranking compared to the other three program models presented.

2. Cost Analysis

The cost analysis below, using the normalized figures presented in Appendix B of this document are an approximation for the PRND capability of the Los Angeles County Sheriff's Department's PRND Program. Actual costs may vary from region to region and this is best used as a planning factor for agencies considering starting a PRND program of this size and scope.

[87] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety

[88] Ibid.

LASD PRND PROGRAM

Equipment:	455 PRDs	@	$1,000 each	$455,000
	12 RIIDs	@	$20,000 each	$240,000
	1 High Res RIID	@	$100,000 each	$100,000
	8 Backpacks	@	$45,000 each	$360,000
	6 Mobile Systems	@	$100,000 each	$600,000
Training:	3,000 for PRD Training (1hour* In Service)			$187,500
	50 for RIID Training (2 days)			$50,000
	50 for Backpack Training (1 day)			$25,000
	25 for Mobile System Training (1 day)			$12,500
			TOTAL	$2,030,000

* LASD uses a one hour course as opposed to an eight hour used by all other case studies

Equipment sustainment costs are approximately $86,000 per year.[89]

3. NIMS Typing Analysis

The Los Angeles County Sheriff Department's PRND program easily meets the definition of a NIMS Type I Law Enforcement PRND team as outlined in Appendix C of this document. They can field a number of additional Type II, III, and IV teams as needed, as well as specialized Maritime PRND teams defined in the NIMS document. They also possess hundreds of PRDs that are deployed to field patrol units that would be considered "individual resources" under the NIMS typing approach. This gives LASD the ability to surge detection equipment for steady state, special event, and intelligence driven scenarios throughout the Los Angeles area.

4. Analysis of Qualitative Factors

Political acceptance of the LASD program is considered high. The department is responsible for a large portion of southern California with a dense and diverse population.

[89] Appendix B gives initial and sustainment cost breakdowns for equipment and training for PRND activities.

The Department engages in a full spectrum of counterterrorism activities, and its PRND program compliments its overall strategy. As a major strategic port, its maritime PRND capabilities are currently unparalleled in the area.

A large program, such as LASD, requires steady funding to ensure sustainability. This program has some advantages in this area, as it receives Urban Area Security Initiative (UASI), Port Security Grants, and was recently invited to apply to become the second region in the "Securing the Cities" program (STC), which is shown as the last policy option in this analysis. The program can easily expand into "Securing the Cities," if accepted as it has a solid framework on which to build. However, the LASD has identified training as a weakness. It only conducted one hour of PRD training for three thousand of its personnel and would like to expand the hours of training and number of patrol personnel trained. The acquisition of STC status would make that possible.

5. Program Evaluation

a. **Planning—**The LASD program has a robust Con-Ops, concept of operations, that steers patrol, aviation, and marine operations including procedures for their HazMat detail and special event coverage. They also have procedures for interacting with other response organizations as a situation dictates. The program is based upon the LASD alone, leading to a rating of ***GOOD*** for its planning and related processes.

b. **Organization—**The LASD program is run by its HazMat detail and has a clear chain of command for incident management including joint federal operations and investigations. Again, the single agency model is rated as ***GOOD*** for organizational effectiveness.

c. **Equipment—**The LASD program has extensive equipment capabilities extending to aviation and marine assets built over a period of several years. This approach scores as ***BEST*** in this analysis.

d. **Training—**The LASD PRND program initially provided only in-house training opportunities. Although this was viewed as a weakness its members are well

prepared to conduct the full range of PRND related activities. Currently, the rating of ***GOOD*** is given.

e. **Exercises—**The Los Angeles Sheriff's Department's PRND program participates in a number of exercises each year to hone its capabilities. As the program is single agency focused, most exercises are internal in nature leading to a ranking of ***GOOD.*** In 2010, the department led a large multi-agency drill in conjunction with the FBI.

f. **Operations Support—**LASD utilizes the Joint Analysis Center run by DNDO in Washington, DC and the National Laboratories leading to a ranking of ***BEST***.

The LASD Program can serve as a "model program" for a large single agency program. It interfaces with other response partners as needed to provide comprehensive coverage of the greater Los Angeles metropolitan area. It shows a NIMS Type I capability with subordinate Type II, III, IV teams deployed as needed and individual resources that can be used as a stepped approach for any law enforcement agency pursuing a PRND mission. The program would expand easily in the STC program and its maritime efforts are notable in the area of port security.

6. Option Analysis Summary

Table 4 gives a cost summary and rates the interoperability and expandability of the program, especially if used as a baseline for creating a similar local law enforcement program. The final evaluation of ***GOOD*** is based upon this program being a large local single agency law enforcement program that interacts with other mission partners, such as the ports and airport police in their respective areas of responsibility. The program regularly networks with its federal PRND partners as well.

Table 4. LA County Sheriff's Department PRND Summary

NIMS Type	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
1	**$1,755,000**	**$274,500**	**$86,000**	**YES**	**YES**	**GOOD**

C. WORKING WITH LAW ENFORCEMENT PEERS—MULTI-AGENCY PRND PROGRAM

1. Program Overview—Philadelphia Urban Area Security Initiative Law Enforcement PRND Program

The Philadelphia Urban Area Security Initiative (UASI) PRND program began in 2005 with the Philadelphia Police Department, the agency program described in the next section, and has steadily expanded as funding became available. The current program has four principle partners:

- Philadelphia Police Department
- University of Pennsylvania Police Department
- Bucks County Major Incident Response Team (MIRT)
- Montgomery County Major Incident Response Team (MIRT)

The partnership between the University of Pennsylvania and the Philadelphia Police Department was critical in the development and continued success of the program. Radiation safety professionals from the university actively participate in training and manage the radioactive sources employed by the program. The University specifically modified its Nuclear Regulatory Commission license to have approval to support the PRND Program and training of first responders through the Commonwealth of Pennsylvania. The University of Pennsylvania, its police force, and Philadelphia Police Department served as the model site for the Global Threat Reduction Initiative (GTRI) program, which secures radiological sources used at universities and hospitals.

The Philadelphia UASI PRND program currently is law enforcement centric but actively engages Fire/Hazmat personnel and federal assets, such as the FBI, TSA's VIPR, Coast Guard and National Guard Civil Support Team. The program also works closely with the Pennsylvania Bureau of Radiation Protection and National Nuclear Security Administration.

The program is a regional multi-agency endeavor that uses common equipment, training, tactics, techniques, and procedures that ensures consistency across the five counties of Southeastern Pennsylvania. The program maintains a relationship with the "Securing the Cities" program in New York, New Jersey, and Connecticut, as well as PRND efforts in the National Capitol Region surrounding the District of Columbia.

The Philadelphia UASI Region was invited in May 2012, as was Los Angeles and seven other UASI regions, to apply to become the second "Securing the Cities" program area. The Philadelphia and Los Angeles programs are both well positioned in that regard and their existing programs would provide the necessary framework to expand.

a. Representative Agency Example—Philadelphia Police Department PRND Program Overview

The Philadelphia Police Department considers itself a leader in the Preventive Radiological/Nuclear Detection (PRND) community. Most recently, the Department assisted in the development of the NIMS Typing for PRND assets contained in Appendix C. The standard was officially published in June 2011 and the Philadelphia Police PRND program exceeds the standards for the highest level of capability (TYPE I). NIMS Type I indicates the ability to conduct a wide area radiological / nuclear search with the ability to deploy high resolution isotope identification.

The Department has an extensive array of radiation detection systems that can be mounted on its aircraft, its watercraft, along with a variety of marked and unmarked patrol vehicles. The Department's Counter-Terror Operations Unit serves as the program coordinator and as the archetypical NIMS Type I Team. The department also

deploys additional personnel from Patrol and Special Operations that carry Personal Radiation Detectors (PRD) on a 24/7 steady state basis as part of its overall PRND strategy.

The department works in conjunction with the Philadelphia Fire Department, FBI Hazardous Materials Team, Pennsylvania Bureau of Radiation Protection, the 3rd Civil Support Team of the Pennsylvania National Guard, AMTRAK Police, United States Coast Guard, and the Transportation Security Administration Visible Intermodal Protection and Response (VIPR) Team to provide comprehensive prevention and response capabilities.

The Philadelphia Police Department was the first municipal law enforcement agency to participate in the Global Threat Reduction Initiative (GTRI) program. The National Nuclear Security Administration (NNSA) through the GTRI Program seeks to secure radioactive material used in hospitals, universities, and industrial applications from potential theft and misuse. A number of sites in Philadelphia have received enhanced security systems and training for their employees as part of the GTRI Program. Alarm systems installed at these sites will be monitored at the Delaware Valley Intelligence Center (DVIC) when it becomes operational in 2013.

The succeeding sections evaluate the model's costs, its respective designation under the PRND NIMS Typing,[90] qualitative factors, a POETE-Ops program evaluation, and a respective ranking compared to the other three program models presented.

2. Cost Analysis

The cost analysis, using the normalized figures presented in Appendix B of this document, are an approximation for the PRND capability of the Philadelphia Police Department's PRND Program as part of the larger UASI program. Actual costs may vary

[90] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety.

from region to region, and this is best used as a planning factor for agencies considering starting a PRND program of this size and scope.

PPD PRND PROGRAM:

Equipment:	150 PRDs	@	$1,000 each	$150,000
	8 RIIDs	@	$20,000 each	$160,000
	1 High Res RIID	@	$100,000 each	$100,000
	2 Backpacks	@	$45,000 each	$ 90,000
	1 Mobile Systems	@	$100,000 each	$100,000
Training:	400 for PRD Training			$200,000
	50 for RIID Training (2 days)			$50,000
	32 for Backpack Training (1 day)			$16,000
	10 for Mobile System Training (1 day)			$5,000
			TOTAL	$871,000

Equipment sustainment costs are approximately $26,500 per year.[91]

3. NIMS Typing Analysis

The Philadelphia PRND program meets the minimum definition of a NIMS Type I Law Enforcement PRND team as outlined in Appendix C of this document. They can field a limited number of additional Type II, III, and IV teams as needed, as well as one specialized Maritime PRND team, as defined in the NIMS document. They also possess dozens of PRDs that are deployed to field patrol units that would be considered "individual resources" under the NIMS typing approach. This gives the Philadelphia Police Department the ability to surge additional detection equipment for any steady state, special event, or intelligence driven scenarios as needed. These individual resource PRDs are also deployed around twenty GTRI-protected sites, such as hospitals and universities that are supported by the Type I team during response operations.

[91] Appendix B gives initial and sustainment cost breakdowns for equipment and training for PRND activities.

4. Analysis of Qualitative Factors

Political acceptance of the PPD program and greater UASI effort is considered high. The department is responsible for a large portion of Southeastern Pennsylvania with a dense population and a multitude of special events and critical infrastructure. The department engages in a full spectrum of counterterrorism activities, and its PRND program compliments its overall strategy. Its position as the model site for the GTRI program gives the program a well-deserved reputation, and it routinely assists other police departments in initiating and sustaining PRND efforts.

A large program, such as Philadelphia Police Department PRND effort, requires steady funding to ensure sustainability. This program has some advantages in this area, as it receives Urban Area Security Initiative (UASI), Port Security Grants, and was invited in May 2012, as was Los Angeles, to apply to become the second region in the "Securing the Cities" program (STC), which is shown as the last policy option in this analysis. The program can easily expand into "Securing the Cities," if accepted, as it has a solid framework on which to build. The GTRI effort also provides sustainment funding for the equipment purchased on the department's behalf. This amounts to approximately $10,000 of the $86,000 estimated each year to maintain the program. The program has a three-year plan for expansion by building its NIMS typing capability to ensure reiterative capability not just in Philadelphia but throughout the greater UASI area each year.

5. Program Evaluation

a. **Planning—**The collaborative nature of planning in the multi-agency law enforcement program is stronger than the single agency model leading to a rating of ***BETTER***. The limiting factor is that it utilizes only one discipline, law enforcement, and does not formerly include other response partners.

b. **Organization—**As with planning, the organization of the multi-agency PRND program is collaborative in nature by design. The Philadelphia UASI program is regional and rates as ***BETTER*** in this analysis.

c. **Equipment—**The Philadelphia UASI program has extensive equipment capabilities extending to aviation and marine capabilities built over several years. This commitment to build capability as funding increased scores as ***BEST*** in this analysis.

d. **Training—**The Philadelphia UASI program takes full advantage of DHS administered, as well as in-house, training opportunities. Its members are well prepared to conduct the full range of PRND related activities leading to a rating of ***BEST***.

e. **Exercises—**All exercises conducted by the Philadelphia UASI Program are multi-agency and regional in scope. Most have only involved law enforcement which limits the ranking to ***BETTER***.

f. **Operations Support—**The Philadelphia UASI PRND program utilizes the Joint Analysis Center run by DNDO in Washington, DC and the National Laboratories leading to a ranking of ***BEST***.

The Philadelphia Police Department's PRND program as the principle partner in the greater UASI effort is a solid, well managed entity. It is regional in scope but would benefit from the formal inclusion of other nonlaw enforcement organizations in development of policies and procedures leading to more joint operations during steady state conditions. Operations at special events and intelligence-based scenarios have been successful in the past but would only benefit from daily cooperation of additional agencies. As part of their "Securing the Cities" grant application, the protected region may be expanded to include the entire Metropolitan Statistical Area (MSA) that would integrate parts of New Jersey, Delaware, and Maryland. This is the same geographic coverage area as the Delaware Valley Intelligence Center (DVIC).

6. Option Analysis Summary

Table 5 provides a cost summary and rates the interoperability and expandability of the representative agency program, especially if used as baseline for creating a similar local law enforcement program, as well as a final evaluation rating of ***BETTER***. This

ranking is based upon this program being a large local single agency law enforcement program that interacts with other regional partners including a strong public—private partnership with the University of Pennsylvania. The program regularly interacts with its federal PRND partners and has plans to expand at a steady pace as it has done since 2005. Although not as large as the Los Angeles PRND or as well funded, the Philadelphia UASI Program is strong with a sustainment plan, expandability, and is well placed to become the next "Securing the Cities" site.

Table 5. Philadelphia Police Department PRND Summary

NIMS Type	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
1	**$600,000**	**$271,000**	**$86,000**	**YES**	**YES**	**BETTER**

D. WORKING WITH ALL RESPONSE PARTNERS—A MULTI-DISCIPLINE PRND PROGRAM

1. Program Overview—New York City Regional "Securing The Cities" Initiative PRND Program

The May 7, 2012 Federal Grant announcement concerning the expansion of the STC program described the effort as:

> The Securing the Cities (STC) Program seeks to design and implement or enhance existing architectures for coordinated and integrated detection and interdiction of nuclear materials that are out of regulatory control and may be used as a weapon within high-risk metropolitan areas in the United States. The STC Program will establish sustainable capability among State, local and tribal agencies to detect and report unauthorized nuclear materials within their jurisdictions supporting the Global Nuclear Detection Architecture (GNDA). The STC Program has three primary goals: (1) to enhance regional capabilities to detect, identify and interdict nuclear materials that are out of regulatory control; (2) to guide the coordination of Federal, State, local and tribal entities in their roles defined by the GNDA; and (3) to encourage participants to sustain base nuclear detection program over time.

The program began in 2006 in the New York City Region and encompasses portions of three states: New York, New Jersey and Connecticut. This area forms a forty-five (45) mile buffer zone around New York City in which radiological detection equipment is deployed on a daily basis. The New York City Police Department (NYPD) is the primary of thirteen (13) principle participants that include other law enforcement agencies, the New York City Fire Department (FDNY), and traditional radiation safety professionals. In total, over 150 agencies are involved in program, most are smaller law enforcement departments in the region that are managed by the New Jersey State Police and other larger organizations on behalf of NYPD.

The thirteen (13) principle partners are:

- New York City Police Department
- New York City Department of Environmental Protection
- New York City Department of Health and Mental Hygiene
- New York City Fire Department
- New York State Police / Office of Homeland Security
- Suffolk County, New York, Police Department
- Nassau County, New York, Police Department
- Westchester County, New York, Department of Public Safety
- Rockland County, New York, Sheriff's Department
- New Jersey State Police
- Port Authority of New York / New Jersey
- Metropolitan Transit Authority
- Connecticut State Police

In addition to 1000 PRDs, 100 Radiation Detection Backpacks and five Mobile Systems that are currently on order, the NYPD reported during testimony before the

House of Representatives Committee on Homeland Security in July, 2011[92] that the following equipment had been distributed throughout the NYC region:

- 4,200 + Personal Radiation Detectors (PRDs)
- 156 Radiation Detection Backpacks
- 77 Radiological Isotope Identification Devices (RIIDs)
- 15 Mobile Detection Systems

In addition, several thousand personnel have been trained and a network of 400 check/chokepoints have been identified and exercised as pathways into the city for coverage in an activation of all PRND resources. Steady state operations are conducted throughout the region twenty-four hours a day. A common set of equipment purchases, operational procedures and training programs ensures consistent coverage and response protocols in the three state region protected by the STC program.

The program was slated to be a five year pilot program but, through political maneuvering and the fact that New York City remains the top target in the nation, it has achieved permanent funding status. Funding from 2006 to date has surpassed $60 million dollars.

a. Representative Agency Example—Suffolk County Police Department PRND Program Overview [93]

Suffolk County is located on the eastern portion of Long Island, New York. It has a population of just under 1.5 million people, and it is 2,373 square miles including 912 square miles of land area and 1461 square miles of water. It is the second largest county in New York State. The county has extensive shoreline area, and it is divided into ten townships. The Suffolk County Police Department was created in 1960 and combined numerous town and village police departments into one consolidated county department that provides primary patrol service for the majority of the county and

[92] Daddario, July 2011.

[93] Information provided by Inspector Stuart Cameron, Suffolk County Police Department's PRND Program Manager. Inspector Cameron, and the author, have worked collectively on PRND issues since 2007 as part of the author's position as Philadelphia Police Department PRND Program Manager.

some specialized services to the entire county. The department has approximately 2,600 sworn members, and it is one of the larger police departments in the United States.

In 2004, the department created a preventive radiation detection program as part of its ongoing homeland security efforts. Four hundred personal radiation detectors (PRDs) were purchased utilizing federal homeland security grant funding. The department's Emergency Service Section already possessed radiological isotope identification devices (RIIDS) and various radiological survey devices as part of their county-wide hazardous material team responsibilities. In addition to being the county's hazardous materials team, the Emergency Service Section is also the department's public safety bomb squad, SWAT team and it is tasked with performing various other special operations including heavy rescue and technical rescue.

In 2007, the Securing the Cities (STC) program was started by the Domestic Nuclear Detection Office. This program, funded at over $100 million to date, provides training and equipment to twelve principal agencies and various subpartners located around New York City. Suffolk County is one of the twelve principal partners, and has therefore, received support for training, equipment and exercises. Due to the support from STC and continued use of other federal grants, there are now close to 800 personal radiation detectors deployed throughout Suffolk County with twenty-three law enforcement agencies, including state, county, town and village departments. The program continues to build out, adding new training, equipment and tactics to ensure that this mission is performed in the most efficient and effective manner possible.

The succeeding sections will evaluate the model's costs, its respective designation under the PRND NIMS Typing,[94] qualitative factors, a POETE-Ops program evaluation, and a respective ranking compared to the other three program models presented.

[94] Appendix C contains information on how to obtain the PRND NIMS Typing Document in its entirety.

2. Cost Analysis

The cost analysis following, using the normalized figures presented in Appendix B of this document, are an approximation of the PRND capability of the Suffolk County Police Department's PRND Program as part of the larger "Securing the Cities" effort in the New York City Region. Actual costs may vary from region to region, and this is best used as a planning factor for agencies considering starting a PRND program of this size and scope.

SUFFOLK COUNTY POLICE PRND PROGRAM

Equipment:	764 PRDs	@	$1,000 each	$764,000
	8 RIIDs	@	$20,000 each	$160,000
	1 High Res RIID	@	$100,000 each	$100,000
	7 Backpacks	@	$45,000 each	$315,000
	3 Mobile Systems	@	$100,000 each	$300,000
Training:	2500 for PRD Training			$1,250,000
	50 for RIID Training (2 days)			$50,000
	50 for Backpack Training (1 day)			$25,000
	50 for Mobile System Training (1 day)			$25,000
			TOTAL	$2,989,000

Equipment sustainment costs are approximately $102,900 per year.[95]

3. NIMS Typing Analysis

The Suffolk County Police Department's PRND program easily meets the definition of a NIMS Type I Law Enforcement PRND team as outlined in Appendix C of this document. They can field a number of additional Type II, III, and IV teams as needed, as well as specialized maritime PRND teams defined in the NIMS document. They also possess hundreds of PRDs that are deployed to field patrol units that would be

[95] Appendix B gives initial and sustainment cost breakdowns for equipment and training for PRND activities.

considered "individual resources" under the NIMS typing approach. This gives SCPD the ability to surge detection equipment for steady state, special event, and intelligence driven scenarios throughout the greater New York City area.

4. Analysis of Qualitative Factors

New York City continues to be widely viewed as the primary target for terrorism, and programs such as STC enjoy wide political support and acceptance, as evidenced by the permanent extension of STC well beyond the initial five-year pilot program mandate.

Obviously, such a large program has incurred tremendous start-up and sustainment costs. It would have been difficult to sustain this effort beyond the five-year period in the initial grant without continued funding. The recent competitive announcement for a second program site also recognizes the needed for a sustainment effort and jurisdictions should prepare for those costs beyond the grant life. That is a difficult challenge in tight budgetary conditions and many jurisdictions will find that impossible.

5. Program Evaluation

Planning—The "Securing the Cities" program uses a comprehensive model to planning that leads to input and representation of all principle partner agencies. This truly collaborative model ranks as ***BEST***.

Organization—The committee-style organization of the STC program ensures that each partner agency has a clearly defined role in the overall effort. Each discipline contributes to respective committees leading to a ranking of ***BEST***.

Equipment—Equipment is standardized across the program leading to true multi-discipline interoperability and increased efficiency in procurement leading to a ranking of ***BEST*** in this analysis.

Training—Training is standardized across the program leading to true multi-discipline cooperation and increased efficiency in training delivery and management leading to a ranking of ***BEST*** in this analysis.

Exercises—Exercises are conducted regionally with all disciplines represented ensuring each respective partner agency is well practiced in their role in the PRND effort. This is the most robust exercise model of all options shown and is ranked accordingly as ***BEST***.

f. **Operations Support—**The STC program utilizes the Joint Analysis Center managed by DNDO in Washington, DC and the National Laboratories leading to a ranking of ***BEST***.

This option can be viewed as the optimal conditions for the domestic portion of the GNDA: Multiple response and prevention partners working together over a large geographic area with common equipment, training, and procedures. The downside with such a large program is that absent continued funding it is extremely difficult to sustain. Agencies involved should closely monitor long term sustainment costs in the event that federal funding diminishes and begin to plan for that in all aspects of their homeland security programs, not just PRND efforts.

6. Option Analysis Overview

The "Securing the Cities" program represents the paragon of excellence in PRND programs. It encompasses a multi-agency, and multi-disciplinary approach to radiological / nuclear terrorism prevention that is difficult to match without the large infusion of grant funds made available by the program. Expandability, as shown here, would involve linking this region to another STC region, such as Boston, Philadelphia, or the National Capital Region to further build the defense-in-depth approach envisioned as the domestic portion of the GNDA.

Table 6. Suffolk County Police Department PRND Summary

NIMS Type	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
1	**$1,639,000**	**$1,350,000**	**$102,900**	**YES**	**YES**	**BEST**

E. CONCLUSION

Radiological and nuclear terrorism prevention is increased by steadily adding to the domestic layer of the GNDA. This expansion as discussed herein is intended to increase the number of local law enforcement agencies undertaking PRND activities alone or in concert with others in their region.

This chapter has examined the four policy options in some degree of detail to provide decision makers with informed criteria for selecting a program that complements their existing homeland security objectives. These case studies further illustrate examples of how several jurisdictions approached their entry into the preventive efforts.

Each of the four options has unique characteristics relating to cost, capability, sustainability, and expandability. The final chapter will outline the general findings of this thesis as well as concluding remarks and a series of recommendations for agencies undertaking a new role in the Global Nuclear Detection Architecture.

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V. FINDINGS, CONCLUSION, AND RECOMMENDATIONS

A. FINDINGS

This research has examined the role of law enforcement as a domestic layer of an international effort known as the Global Nuclear Detection Architecture (GNDA). The GNDA seeks to prevent the theft, movement, and use of radiological/nuclear materials by terrorists.

The research seeks to encourage additional law enforcement agencies to adopt Preventive Radiological/Nuclear Detection (PRND) programs as part of their jurisdiction's overall homeland security effort that values the presence of a well-trained, well-equipped and situationally aware law enforcement officers. The existing literature was reviewed, acknowledging that a radiological / nuclear attack is one of the more unlikely terrorism scenarios, albeit it with high consequences worthy of proactive preventive measures.

Four general policy options were introduced for law enforcement decision makers to choose the best course of action considerate of their unique needs and limitations. The comparative costs associated with each program were examined. The core management principles were delineated and ranked as ***LIMITED***, ***GOOD***, ***BETTER***, and ***BEST***. Several of the policy options have a wide range of rankings giving managers the ability to blend program types where applicable and create hybrid options not specifically analyzed.

The succeeding sections contain a tabular recap of the findings, a conclusion, and a series of recommendations. It is hoped that a law enforcement agency of any size, regardless of whether they begin a formal program or not, can take away lessons and strategies that can be instituted in their operations. Several of the recommendations can be implemented for little or no cost and serve to raise awareness of the threat.

B. PROGRAM MATRIX

Table 7 summarizes the findings of the analysis found in the previous chapter.

Table 7. Analysis Matrix (Costs, Interoperability, Expandability)

Program Model	Equipment Costs	Training Costs	Sustainment Costs	Interoperability	Expandability	Overall Program Evaluation
Fed PRND	VARIES	VARIES	VARIES	LIMITED	YES	**LIMITED**
Single Agency	$1,755,000	$274,500	$86,000	YES	YES	**GOOD**
Multi-Agency	$600,000	$271,000	$86,000	YES	YES	**BETTER**
Multi-Discipline / Multi-Agency	$1,639,000	$1,350,000	$102,900	YES	YES	**BEST**

Table 8 summarizes the findings of the analysis found in the previous chapter.

Table 8. Analysis Matrix (POETE-Ops)

Program Model	Planning	Organization	Equipment	Training	Exercises	Operations Support
Fed PRND	LIMITED	LIMITED	LIMITED	LIMITED	LIMITED	BEST
Single Agency	GOOD	GOOD	BEST	GOOD	GOOD	BEST
Multi-Agency	BETTER	BETTER	BEST	BEST	BETTER	BEST
Multi-Discipline / Multi-Agency	BEST	BEST	BEST	BEST	BEST	BEST

C. CONCLUSION

Since September 11, 2001, American policing has undergone a fundamental transformation. Traditional crime fighting and the public service mission have been expanded to include roles in the homeland security enterprise. Matters once thought to be squarely within the domain of the United States Government as part of national security have become commonplace at the local level. The area of nuclear and radiological terrorism prevention is an example of this transformation. Most law enforcement officers beginning their careers prior to 9/11/01 would never have envisioned an expanded role in this area, let alone, involving carrying radiation detection equipment as part of their normal patrol duties. An attack of this nature is truly a "black swan" by definition—an extremely remote possibility but with staggeringly high consequences. The successful detonation of a nuclear weapon within the United States would change our country on a scale unimaginable at this time. A lesser impact would be the use of a radiological dispersal device or RDD, but even that could cost billions to clean up and years from which to recover.

The Global Nuclear Detection Architecture attempts to create a multi-pronged "defense in depth" strategy to increase the probability of detection and project a deterrence effect to cause a potential adversary a moment of pause to reconsider if such an attack is likely to succeed. This thesis posits that law enforcement adds a distinctive, if not even the last, layer of this worldwide effort. By harnessing law enforcement's unique blend of familiar crime fighting, community policing, and terrorism response skills they add greatly to the domestic front of nuclear and radiation terrorism prevention.

There are expenses associated with this effort. In terms of personnel, training, procuring equipment and sustainment, costs can be substantial. Some agencies may find their involvement cost prohibitive and chose to leave the mission to federal forces. Economic struggles and competing attention with more traditional crime prevention and response duties will tax some agencies' personnel to the point where this additional duty is not practical. Others will choose a policy option presented here and join the PRND effort at a starting point appropriate for their agency. Programs will vary in size and

scope as shown in the research. Every case study used is scalable. Larger agencies and their programs were used as examples but the management aspects apply to departments of every geographical and personnel size. The principle missions—Steady—State, Enhanced Steady State/Special Event, and Intelligence-Driven search operations—are found in every community in varying degrees. The knowledge that such operations exist at the federal level may raise awareness in some departments. They can, in turn, at least minimally plan for support and participation if the need arises in their communities.

The law enforcement agencies, some of which have been used as case studies in this thesis, that decided to embrace this mission have added to the layered defense and protection of our nation as envisioned by the GNDA. Increasing that number of agencies only heightens the probability of detection and enhances all of law enforcement's roles in homeland security and defense, regardless of the PRND option utilized.

Agencies are strongly encouraged to educate their personnel on the reality of radiological and nuclear threats, locate and liaise with sites and organizations that store and use radioactive material, and assist in the physical security and response to those sites. They must also partner with agencies actively pursuing the PRND mission, and assist in providing an ever increasing blanket of overlapping detection and deterrent capability. This recommended strategy is expressed as PREPARE, PROTECT, PARTNER, and PROVIDE.

D. RECOMMENDATIONS

1. Prepare

The first step in this process is to make the decision that it worthwhile for the law enforcement agency to engage in PRND efforts. This can take several forms and does not necessarily entail creating a formal PRND program like those shown in this thesis. Many of those agencies began at this step of preparation and logically grew as funding and capabilities expanded, increasing steadily toward their current state.

An agency can begin by educating its employees about the threat of nuclear and radiological terrorism. There are a number of web-based training courses that can be

accessed on FEMA's website (www.fema.gov) that cover awareness level material. The Domestic Nuclear Detection Office is in the process of creating training products aimed at executive leaders and elected officials in a similar focus. If the majority of law enforcement officers took as little as two hours to educate themselves on the threat, became more aware of the materials that are used and transported within and around their communities, it would increase the probability of detection and enhance the deterrence factor without the purchase of a single piece of equipment.

The next step would be for an agency to locate and develop a relationship with sites and organizations that use, store, or transport nuclear and radioactive materials. These include hospitals, universities, industrial sites, government laboratories, power generating stations, and waste facilities. It is advantageous to have an existing relationship and discuss mutual concerns such as emergency response to the site before to an incident occurs. Patrol officers making random unscheduled visits to these sites can discourage the "insider" threat discussed in the background section. If employees see there is a strong relationship between law enforcement and their organization, they may be more encouraged to share intelligence and information and be deterred from becoming involved in a terrorism event. Similar to awareness training mentioned previously, the relationship component is cost neutral and can singularly increase the strategic goals of the GNDA.

2. Protect

Once the education and liaison steps are fulfilled, the path continues to protection of the sites and the community served by the law enforcement agencies. The National Nuclear Security Administration's (NNSA) Global Threat Reduction Initiative (GTRI) is a program mentioned several times in this document. It seeks to add voluntary, government funded, security upgrades to physical locations that store and use radioactive materials that could be used to make a radiological dispersal device (RDD). The most common type of sites involved in the program are hospitals with Cesium or Cobalt blood irradiators. The GTRI program also provides training and equipment, such as personal radiation detectors (PRDs), to local law enforcement agencies that are responsibility for

protection and response to the site. The program provides training on how to use the PRDs as well as a three-year maintenance, calibration, and sustainment program to offset costs to the agency. Several programs evaluated in this document benefited greatly from this initiative and built their capability by being involved in NNSA's effort to secure vulnerable sites across the nation. Agencies are strongly encouraged to explore this as an option to begin or augment their PRND efforts.

3. Partner

Collaboration is cited throughout the homeland security enterprise as critical and is equally important in the Preventive Radiological / Nuclear Detection (PRND) program model. In the recommendations above, locating and establishing a relationship with at-risk sites in their patrol areas begins the process of partnering. It is further enhanced by inclusion in the GTRI program if available in the respective jurisdiction. If not, agencies should consider initiating a smaller effort—a NIMS Type IV or nontyped operation by placing several PRDs in the hands of patrol personnel. By establishing a relationship with other response agencies such as fire, hazardous materials, radiation safety professionals, or the National Guard Civil Support Team, a program can expand through the collaboration and costs spread across several budgets. The NIMS Typing document in Appendix C provides more information on joint multi-disciplinary PRND teams. It has been stressed throughout this thesis that law enforcement agencies make critical additions to this effort and inclusion in existing nonlaw enforcement efforts can be a powerful force multiplier. If equipment cannot be acquired due to funding or other constraints, agencies should strongly consider providing personnel to existing detection efforts implemented by other organizations to add the interviewing/interrogation, arrest/detention, and use of force expertise not indigenous to other disciplines. This again represents a low or no cost option for inclusion in nationwide PRND efforts and benefits all the agencies involved whether public safety and emergency response driven or private sector sites seeking additional security to protect at-risk materials.

4. Provide

By educating agency personnel, partnering with other public and private organizations, deploying detection and interdiction personnel, law enforcement provides another layer of the Global Nuclear Detection Architecture. The GNDA begins overseas by protecting sites in foreign countries storing at-risk material, then protects our borders by scanning cargo at foreign ports and domestic border crossings, but truly ends in the realm of America's police whose inclusion provides a unique blend of traditional crime fighting with a role in national security.

Agencies should strongly consider examining the PRND programs detailed in this document, find a starting point and begin involvement in the prevention of nuclear and radiation terrorism. The first three steps can be scaled as funding and personnel resources are available and not every agency needs to develop a NIMS Type I PRND operation. It is acknowledged that substantial financial resources are involved in several programs contained herein and most jurisdictions do not have access to that level of homeland security funding. All agencies can find a role whether it be awareness training or building relationships with existing stakeholders.

America's police have a long and proud history of protecting its communities and citizenry. It transformed itself in the wake of the tragedy of September 11 and rose to the new mission of terrorism prevention as well as crime related and public safety duties. Its members significantly contribute to the PRND mission and fill a critical function in the GNDA. By taking an active role in these operations, they may very well prevent the most horrific attack that our nation has ever endured. Law enforcement officers serve as hunters against this "black swan" and our nation and the entire world benefit from their service.

E. OPPORTUNITIES FOR FUTURE RESEARCH

1. Legal Aspects of Preventive Radiological Nuclear Detection Operations

One view of Preventive Radiological / Nuclear Detection not discussed in this thesis addresses the legality of these operations. This thesis solely concentrates on program development options from a capability and equipment standard comparison. The fundamental reason that there is no comment on the legal perspective is that, as of publication, there is no case law at the local, state, or federal level. Different local and state legal advisors have implemented varying policies throughout the nation. A Naval Postgraduate School colleague from the Transportation Security Administration is currently conducting research in this area and the body of knowledge will surely benefit from its conclusions.

2. New Technologies for Enhancing Law Enforcement Training for the Radiological/Nuclear Threat

This thesis concentrated on costs associated with the initial purchase and training for various types of detection equipment used by law enforcement agencies engaged in the PRND mission. It also included estimates for maintenance and calibration of equipment to sustain its operation. Not fully addressed here is the recurring personnel training for the PRND mission especially in light of the remote nature of an actual event occurring.

Currently, there are educational opportunities that provide introductory training and some agencies have used those on a repeated basis to ensure competency with the equipment. There are several initiatives for dedicated recertification training including web-based and "first person shooter" type virtual reality simulations. It is important to note that many younger first responders in all disciplines are likely to expect to receive some training in methods that are not readily available (e.g., self administered web-based or interactive training). Their respective benefits and shortcomings deserve their own dedicated research. Exercises must be developed to maintain a high state of operational

readiness despite a lack of real world incidents to model. Nuclear and radiological exercises are complex to develop and evaluate and benefit from focused study not provided herein.

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APPENDIX A. BACKGROUND INFORMATION: NUCLEAR AND RADIOLOGICAL TERRORISM

Nuclear and Radiological Terrorism are part of the spectrum of threats faced today in the United States. Law Enforcement plays a vital role in protecting the homeland against the entire array of possible attack scenarios.

This section will define and outline the various aspects of nuclear and radiological terrorism including definitions, history, groups associated with, types of weapons possible, and strategies to counter the threat beginning globally but ending with a role for local law enforcement.

The Federal Emergency Management Agency (FEMA) defines terrorism as:

Terrorism is the use of force or violence against persons or property in violation of the laws of the United States for purposes of intimidation, coercion, or ransom.

Terrorists often use threats to:

(4) Create fear among the public.
(5) Try to convince citizens that their government is powerless to prevent terrorism.
(6) Get immediate publicity for their causes.

Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons.[96]

As is shown in the above definition, there are incidents that may involve Chemical, Biological, Nuclear, Radiological, and Explosive agents. These five types of terrorism provide for the acronym CBRNE terrorism. There are specific challenges and considerations to each piece of the CBRNE threat spectrum. Definitions for Nuclear and Radiological terrorism are shown below.

[96] FEMA website.

Nuclear Terrorism is defined as the use or threat of use of a nuclear explosive device of any type by an individual or a group for terrorist purposes. A nuclear explosive device is defined as a device capable of producing an explosive yield through a nuclear chain reaction.[97]

Radiological terrorism is defined as the use or threat of use of radiation for terrorist purposes by means of such methods as a radiological dispersal device (RDD), or "dirty bomb," that would disperse radioactive substances, for example. Other methods include sabotage of nuclear-power plants, nuclear research units, or other nuclear facilities with the goal of causing a dispersal of radioactive material. The fundamental difference between nuclear and radiological terrorism is that the latter does not feature production of a nuclear yield achieved through a nuclear chain reaction.[98]

It should be noted that the vast amount of CBRNE terrorism events that occur are explosive in nature. The National Counterterrorism Center's (NCTC) 2009 Report on Terrorism states there were approximately 11,000 terrorist attacks carried out in 83 countries resulting in over 58,000 victims.[99] Armed assaults topped the list of types of attacks with 4,832 incidents followed by bombings with incidents totaling 4,050.[100] There were no incidents of Nuclear or Radiological terrorism in the 2009 report. Why then should the United States expend effort in curtailing the possibility of a nuclear or radiological attack? Quite simply, because the effect of a single well placed attack could be of such magnitude that all other attacks in recent history would pale in comparison. A recent Congressional Research Report stated, "Cleanup costs after an RDD (Radiological Dispersal Device) attack could range from less than a billion dollars to tens of billions of dollars depending on area contaminated, decontamination technologies used, and level of

[97] The U.S.-Russia Joint Threat Assessment on Nuclear Terrorism (2011), 13.

[98] Ibid., 13.

[99] NCTC 2009 Terrorism Report, 9.

[100] Ibid., 22.

clean up required."[101] Another factor to consider unique to radiological and nuclear materials is that the existing public fear of radiation would intensify the effect on the nation's psyche.

Two final definitions are needed prior to continuing the discussion of Nuclear and Radiological terrorism. Those remaining are the definitions of nuclear and radiological materials and their uses, since they are often confusing to the public and policy makers alike.

Nuclear Materials—often referred to as "special nuclear materials (SNM): "Special nuclear material" (SNM) is defined by Title I of the Atomic Energy Act of 1954 as plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or uranium-235.[102] To the lay person, these are materials that can be used to cause nuclear explosions like the bombs dropped on Hiroshima and Nagasaki, Japan at the end of World War II.

Radioactive Materials—materials that contain radioactive atoms. Radioactive atoms are unstable; that is, they have too much energy. When radioactive atoms spontaneously release their extra energy, they are said to decay. All radioactive atoms decay eventually, though they do not all decay at the same rate. After releasing all their excess energy, the atoms become stable and are no longer radioactive. The time required for decay depends upon the type of atom.[103] These materials are used in industry and medicine and cannot be used to create a nuclear explosion. However, they can be used with explosives to spread contamination.

The historical record for this type of terrorism is limited. The only use of nuclear weapons outside of testing was done by the United States at the end of World War II. A threat assessment report produced by Harvard University's Belfer Center outlined three organizations that expressed interest in pursuing nuclear weapons as a terrorism objective. They are Al-Qaeda, North Caucasus Groups in the former Soviet Union, and

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[101] Medalia, 1.

[102] Nuclear Regulatory Commission Website. www.nrc.gov.

[103] State of New Jersey Dept of Environmental Protection Website. www.state.nj.us/DEP.

the Japanese terror cult Aum Shinrikyo.[104] None of the groups are believed to have successfully acquired or produced weapons but have shown an interest in obtaining them. Acquisition (including purchase of a nuclear weapon by terrorists) from a nuclear-armed country will also be discussed.

Radiological terrorism can be illustrated in a November1995 incident in Chechnya when rebels partially buried a container with a small quantity of cesium-137 in Moscow's Ismailovsky Park. The Chechen leader then notified a Russian television crew, which located the container. This is the first widely reported incident of radiological terrorism. [105]

Again, it can be asked if there is little or no history of this type of terrorism then why is it such a concern to the United States? An answer can be evidenced in the following:

The joint United States and Russia threat assessment concludes, "Nuclear terrorism is a real and urgent threat. Given the potentially catastrophic consequences, even a small probability of terrorists getting and detonating a nuclear bomb is enough to justify urgent action to reduce the risk."[106]

Two of the fifteen "National Planning Scenarios" involved nuclear and radiological terrorism. The Federal Emergency Management Website describes the purpose of the scenarios—"The fifteen all-hazards National Planning Scenarios are an integral component of DHS's capabilities-based approach to implementing Homeland Security Presidential Directive 8: National Preparedness (HSPD-8). The scenarios serve as the foundation for the development of homeland security tasks, target capabilities, and standards and performance metrics against which capabilities and tasks will ultimately be measured. The scenario-derived capabilities and standards serve as a basis for assessing

[104] The U.S.-Russia Joint Threat Assessment on Nuclear Terrorism (2011), 10–11.

[105] Nuclear Threat Initiative Website.www.nti.org .

[106] The U.S.-Russia Joint Threat Assessment on Nuclear Terrorism (2011), 3.

national preparedness; help guide federal preparedness assistance to state, local, and tribal governments; and assist in development of national exercises and training programs."[107] The descriptions of both are below:

National Planning Scenario #1: terrorist members of the Universal Adversary (UA) group plan to assemble a gun-type nuclear device using highly enriched uranium (HEU) stolen from a nuclear facility in another country. The nuclear device components are smuggled into the United States, and the device is assembled near a major metropolitan center. Using a delivery van, terrorists plan to transport the device to the business district of a large city and detonate it.[108]

National Planning Scenario #11: the Universal Adversary (UA) purchases stolen cesium chloride (CsCl) to make a radiological dispersal device (RDD), or "dirty bomb." The explosive and the shielded cesium-137 (137Cs) sources are smuggled into the country. Detonator cord is stolen from a mining operation, and all other materials are obtained legally in the United States. Devices are detonated in three separate, but regionally close, moderate-to-large cities.[109]

Two recent United States government publications underscore this concern despite a successful occurrence of nuclear or radiological terrorism having taken place. The first is the June,2011 National Strategy for Counterterrorism which states "The danger of nuclear terrorism is the greatest threat to global security."[110] The second is the recently released Department of Homeland Security report outlining progress on implementing the recommendations of the 9/11 Commission. The original 9/11 report recommended, "Strengthen counter proliferation efforts to prevent radiological/nuclear terrorism"[111] and the progress report gives reinforcement with the following progress statement: **"**Countering nuclear, biological, and radiological threats requires a

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[107] Federal Emergency Management Website. www.fema.gov.

[108] Ibid.

[109] Ibid.

[110] National Strategy for Counterterrorism, June 2011.

[111] 9/11 Commission Report, 381.

coordinated, whole-of government approach. The Domestic Nuclear Detection Office (DNDO)—formed in 2005 as part of DHS—works in partnership with agencies across federal, state and local government to prevent and deter attacks using nuclear and radiological weapons through nuclear detection and forensics programs and activities."[112]

To summarize this section, it is easy to assume that the threat of a successful nuclear or radiological terrorism event would be remote. However, the aftermath would be so catastrophic that a prevention strategy is essential. Ted Lewis advocates an "80–20" rule in his book, "Bak's Sand Pile" where a nation would invest 80 percent in prevention and 20 percent in response for hazards with high risk profiles."[113] Nuclear and radiological terrorism certainly have a high risk profile although being rare events in general. This would support our government's effort in the prevention of this type of terrorism as envisioned in the Global Nuclear Detection Architecture (GNDA) and law enforcement's participation in its objectives discussed in Part Two of this document.

There are four basic types of attacks that a terrorist group could employ in the nuclear and radiological terrorism realm. Each has advantages and disadvantages requiring slightly different methods for detection and interdiction. They are listed below and will be followed by a description and narrative discussing some issues in obtaining and carrying out an attack.

The four possibilities are:

(1) Improvised Nuclear Device (IND)
(2) Radiological Dispersal Device (RDD)
(3) Radiological Exposure Device (RED)
(4) Hoax

Improvised Nuclear Device (IND)- The most devastating of all possibilities, this is a fully functioning weapon capable of a nuclear explosion. These would be constructed using highly enriched uranium or plutonium and following basic designs that have been

[112] Implementing 9/11 Report Recommendations, July 2011.

[113] (Lewis 2011).

in use for almost 70 years. The device in National Planning Scenario #1 had a yield of 10 kilotons of TNT and was estimated to cause 100,000 casualties.[114] That yield is conservative reflecting a base model IND nowhere near the destructive capabilities of weapons in American and Russian arsenals. There are eight nations that possess nuclear weapons: United States, Russia, China, Great Britain, France, Israel, India, and Pakistan. North Korea and Iran are believed to be in varying levels of development.

Existing weapons could be stolen, although that would represent an extreme event, as security is a paramount concern to the nuclear nations. One country, Pakistan, does concern some due to recent events questioning the stability of their government. A recent report from Global Security Newswire commented on a scenario involving diversion of Special Nuclear Material (SNM), as opposed to completed weapon[115]. That would be a more plausible option but would require an "insider" to assist and facilitate the process. The acquisition of weapons grade SNM is the biggest obstacle in the construction of an IND, if a completed weapon is not available. North Korea and Iran could sell a weapon to terrorists but most discount that as unlikely because such transactions can be traced back to them and would certainly result in retaliation from the United States and its allies.

Zimmerman and Lewis state that for a mere $5,433,000, a weapon could be built (including purchasing weapons grade material on the black market) and used against a United States target. [116]

In summary, INDs have the strongest impact but maintains the least probability for nuclear and radiological terrorism. Perhaps triggering a re-application of the 80–20 rule where 20 percent of prevention efforts are focused on the IND threat and 80 percent on the remaining threats would be wise.

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[114] Federal Emergency Management Website. www.fema.gov.

[115] Global Security Newswire July 8.

[116] (Zimmerman and Lewis, 2006).

Radiological Dispersal Device (RDD)—This represents a much simpler project for a terrorist organization to undertake. In this option, conventional explosives are coupled with a radioactive material and the explosion causes the radioactive material to be spread over a wider area resulting in contamination. There would likely be few deaths, other than from the direct effects of the explosion, and most damage would be economic due to clean up costs. These are often referred to as "weapons of mass disruption" due to the economic impact versus the immediate causalities of an IND. It is important to remember that the essential element to a RDD is the dispersal of radioactive material to create contamination. Therefore, a RDD attack can be accomplished without explosives by dispersing as a powder into a ventilation system of a building or merely into the air, or mixing a powdered material with water and spraying it.

The only hurdle for a terrorist organization is obtaining the radioactive material. Since they are not seeking Special Nuclear Material (SNM) the choices are more abundant and available. There are several industrial and medical radioactive materials that would work well in an RDD. For discussion purposes this paper will examine two: Cobalt 60 and Cesium 137. Both are strong industrial sources that emit gamma radiation, which in great amounts is harmful to human beings.

Again, to limit the discussion, one application will be cited where Cobalt and Cesium are used. That use is radioactive materials being used as blood irradiators, which are used in hospitals and universities to sterilize blood and other tissues for transfusions and other research. It can be agreed that security is reduced in these settings compared to a nuclear power plant or facility where weapons are stored. They may be seen as "soft targets" by terrorists due to the public nature of the facilities. Ken Sheely, from the National Nuclear Security Administration (NNSA), estimates that there over 2,700 sites in the United States where these materials are used.[117] The NNSA is providing security upgrades to many of these facilities through its Global Threat Reduction Initiative (GTRI).

[117] Global Security Newswire March 22, 2011.

An interesting case to examine in the discussion of RDDs involves an incident from Goiania, Brazil in 1987 where a Cesium 137 source was removed from an abandoned medical facility and spread through the community as a curiosity. There was no attempt to deliberately disperse the material yet the effects included 4 fatalities, 23 serious injuries from radiation exposure, 129 persons contaminated from the Cesium and 112,800 persons screened for exposure.[118] Goiania is often cited as an example for RDD planning. The effects of a deliberate dispersal would obviously be several orders of magnitude higher.

Radiation Exposure Device (RED—This is the simplest form of an actual attack for a group interested in nuclear and radiological terrorism. Materials like Cesium or Cobalt described above are placed in a public area exposing people passing by. There would not likely be any immediate symptoms from the radiation exposure and the perpetrators would notify the media to help spread public concern. This type of attack is similar to the November, 1995 event described earlier in Chechnya where Cesium was placed in a public park and the media was alerted. Methods to obtain the material needed mirror those used in the RDD acquisition, which again would be easier than in the case of an IND.

Hoax—It cannot be discounted in this discussion that a well-executed hoax where there is no device or material has the potential for terror, as well. A group without the resources to obtain radioactive material or other attention seekers could perpetrate a hoax causing resources to be allocated for its investigation. This can be magnified through notification to the media to raise public alarm and concern. In the Goiania incident described above, once it became public knowledge that material had been spread through the community almost 113,000 people sought screening.[119] Imagine what the effect would be in a United States city if residents thought they had been exposed to radiation either through an RDD or RED.

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[118] Wm. Robert Johnston May 2005.

[119] Ibid.

A well-planned IND/RDD hoax in a major United States city could cause the deployment of several federal, state, and local teams and result in several days of search efforts until declared a hoax by federal officials. It would likely be determined that search efforts are warranted as a precaution, due to the nature and specificity of the threat.

APPENDIX B. PREVENTIVE RADIOLOGICAL/NUCLEAR DETECTION MISSIONS, EQUIPMENT TYPES AND CAPABILITIES

A. PREVENTIVE RADIOLOGICAL/NUCLEAR DETECTION MISSION TYPES

1. Radiological Material Site Protection / Response

This mission involves identifying locations such as hospitals, universities, and industrial sites that use and/or store radioactive materials in their daily functions. Locations where Cesium 137 and Cobalt 60 are most interesting because they possess the most likely useable material for a "dirty bomb," as described earlier in Appendix A.

2. Steady State Patrol Operations

These are routine patrol operations where detection equipment is deployed with the officers minus intelligence or threat information. The deployment can be foot patrol, vehicle patrol, or utilizing airborne and marine assets. Detection is accomplished through the use of Personal Radiation Detectors (PRDs), sometimes referred to as "radiation pagers." They are typically worn on the officer's gun belt and they alert the officer to the presence of radiation that may require investigation, a process that will be discussed in a later section. Vehicle-based systems, including law enforcement air and marine craft, will carry larger, more advanced detection equipment to cover larger patrol areas more efficiently.

a. Special Event / Enhanced Steady State

These are operations that mirror steady state but are focused on special events. These events range from a local venue like a parade or county fair to large national events like the Super Bowl and World Series. There are some nuances to tactics particular to special events that dictate the differentiation between steady state and enhanced steady state which lay outside the scope of this examination.

b. Intelligence Driven Search Operations

This is the deployment of PRND assets in conjunction to a threat or gathered intelligence. It may be conducted in a low visibility or covert manner. It may involve integration of many agencies from federal, state, and local organizations depending on the area involved and specifics of the threat. Again, this mission has operational differences from Steady State and Enhanced Steady State although it is important to note that during threat conditions, a mix of all three missions may be employed for maximum deterrence.

c. Common Mission Activities

Within the three missions listed above are three core activities for law enforcement agencies involved in PRND activities. The three activities are:

- Primary Screening
-Secondary Screening
- Technical Reach-Back

(1) Primary Screening

Primary Screening occurs when an officer is alerted by their detection equipment of the presence of radiological or nuclear material. The officer will attempt to verify the alarm, locate the source of the detection, and determine if it is a threat or not. The vast majority of law enforcement encounters with the public in primary screening are with persons who have had a medical or diagnostic procedure involving placing radioactive materials inside their body. The most likely event is a cardiac stress test involving an injection of the isotope Technetium 99. Patients may be detectable for several days afterward and from some distance away, and may present a letter from a doctor or hospital outlining the procedure. Some will not even be aware they have radioactive material in their body and that detectors are able to "see" them. Primary screening is the proverbial "needle in the haystack" scenario where officers must sort through legitimate sources looking for an illicit one. Most primary screening encounters are accomplished through an interview. This is when law enforcement officers have a distinct set of knowledge, skills, and abilities. Officers have years of experience in

interviews, interrogations, deception detection, behavioral analysis, and intuition that gives them a clear edge in primary screening activities.

(2) Secondary Screening

Secondary Screening occurs when the primary screener cannot determine through the interview process whether the radiation detection is legitimate. Specialized personnel from a different discipline may respond with more sophisticated equipment to determine the type and source and the detection. In some jurisdictions, Fire Department Hazardous Materials Teams or State Radiation Control officials perform this function. Most seasoned law enforcement PRND programs, such as New York City, Philadelphia, Los Angeles, and Washington, DC have officers that routinely perform secondary screening without such assistance.

(3) Technical Reach-Back

Technical Reach-Back occurs when secondary screening personnel cannot resolve the detection or encounter with Special Nuclear Material (SNM). As a result, the jurisdiction will contact DNDO's Joint Analysis Center (JAC). Their activities are described on DNDO's website as:

The JAC provides 24/7 capabilities to maintain situational awareness of the Global Nuclear Detection Architecture (GNDA), analyze information from the GNDA, law enforcement and intelligence communities. The JAC then shares the collected data and information with the Communities of Interest (COI) to enable the GNDA to become more effective, and ensure that detection leads to an appropriate response through the development of appropriate alarm adjudication protocols and facilitating the execution of those protocols. The JAC:

- *Provides technical reach-back and alarm adjudication at the national level*
- *Develops radiological/nuclear awareness products: State Books, Cargo Reports*
- *Provides continuous sharing of information and databases with the Intelligence Community, counterterrorism resources, Fusion*

Centers, FBI, JTTF, DOE, CBP, DOS, and other U.S. government agencies as well as state, county and municipal law enforcement communities[120]

As is the case with secondary screening in some jurisdictions, another discipline, the Department of Energy Radiological Assistance Program (RAP) teams or the Federal Bureau of Investigation, may handle the technical reach-back. Most seasoned law enforcement PRND programs, such as New York City, Philadelphia, Los Angeles, and Washington, DC have officers that routinely interact with the Joint Analysis Center on a regular basis concerning detection events.

2. Equipment Types / Costs / Capabilities

a. Personal Radiation Detectors

Personal Radiation Detectors, commonly known as PRDs, form the backbone of law enforcement PRND programs. These small, belt-mounted detectors, designed to be carried by the individual patrol officer, are sometimes referred to as "radiation pagers" due to their size and resemblance to conventional communications pagers or Blackberry-like devices. They detect and reverberate in the presence of one or more forms of radiation alerting the officer to its presence. For the sake of this discussion, most will detect gamma radiation, which is the material most likely to be used in a "dirty bomb", or radiological dispersal device (RDD). Some will detect neutron radiation, which is likely to be emitted from Special Nuclear Material (SNM) being employed in an IND – Improvised Nuclear Device.

[120] DHS website.

Figure 3. Personal Radiation Detector (PRD)

Once detection is realized with a PRD, the officer will investigate and adjudicate the alert in accordance with their departmental protocols. This may involve interviewing a person, or calling for more specialized equipment used in secondary screening described earlier in the Mission/Task section.

Cost per PRD can vary from $300 to $3,000 or more based on its functions and whether or not it can detect neutron radiation. In Appendix C, there is information on how to obtain NIMS Resource Typing Definitions for PRDs based on instrument capabilities.

For this examination, the cost of a PRD is normalized to $1,000 with a $100 annual maintenance and calibration cost. The cost of training is estimated at eight hours at a nominal rate of $500 total. The Department of Homeland Security offers approved courses to educate law enforcement officers in the deployment of PRDs. Homeland security grant funds may be expended to receive this training. These cost estimates are used throughout the policy option analysis.

b. Backpack / Portal Detection Systems

Another primary screening tool commonly used by law enforcement PRND programs are radiation detection backpacks. These are essentially large PRDs worn on the officer in a modified backpack. There are efficient for screening large venues such as a sports stadium in a shorter period of time and with fewer personnel than using small PRDs alone. This efficiency factor is estimated at 25, assuming that one

backpack is equivalent to deploying 25 PRDs. Backpacks can be removed and placed independently or in combination to form "portals" which pedestrians and vehicles pass through during screening operations.

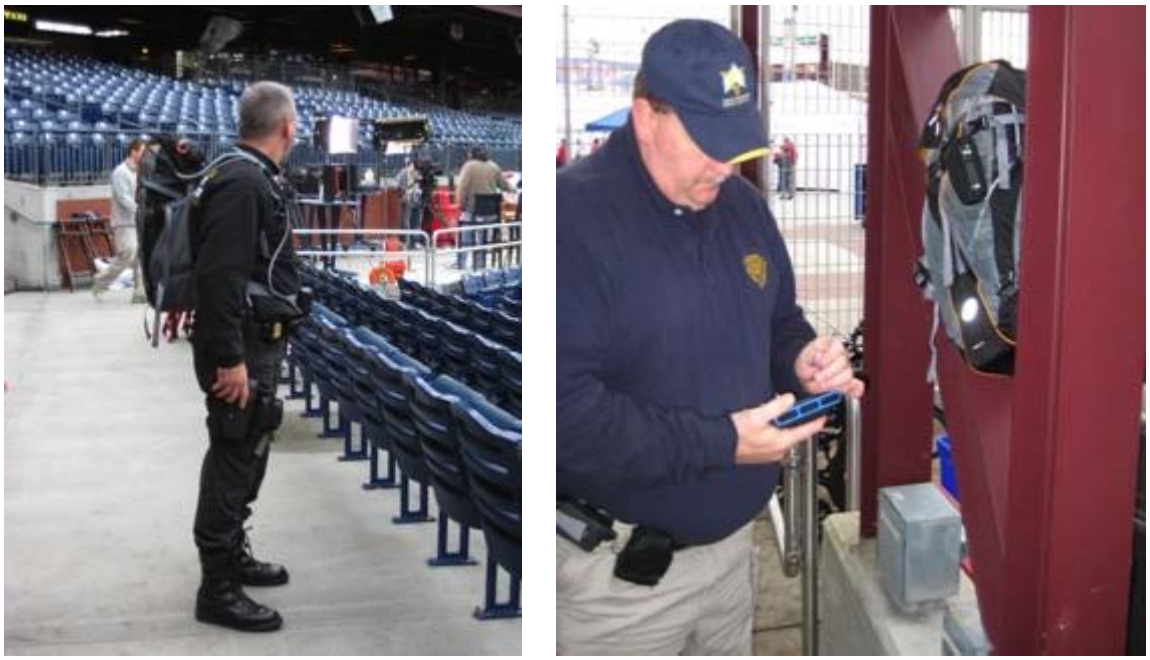

Figure 4. Radiation Detection Backpack being employed as a search tool and Portal at 2008 World Series

Cost per Radiation Detection Backpack can vary from $20,000 to $60,000 or more based on the available functions and whether or not it can detect neutron radiation. In Appendix C, there is information on how to obtain NIMS Resource Typing Definitions for Radiation Detection Backpacks based on instrument capabilities. There are some backpacks in the NIMS typing (Type I) that perform secondary screening and isotope identification; however, this greatly increases the cost and subsequently, they are not widely used.

For this examination, the cost of a Radiation Detection Backpack is normalized to $45,000 with a $1,000 annual maintenance and calibration cost. The cost of training will be estimated at eight hours at a nominal rate of $500 total. The Department of Homeland Security offers approved courses to educate law enforcement

officers in the deployment of Radiation Detection Backpacks. Homeland security grant funds may be expended to receive this training. These cost estimates are used throughout the policy option analysis.

c. Radiological Isotope Identification Devices

Radiological Isotope Identification Devices, commonly called RIIDs, are secondary screening tools used to resolve detection alarms encountered by primary screeners using PRDs or Radiation Detection Backpacks. They collect energy emissions from the radioactive sources called "spectra" and the spectra are then compared to known samples contained in the instrument's internal library. The simplest explanation is that they take a "fingerprint" of the radiation and compare it to a database of known radiation sources to determine what radioactive isotope is present and its likely use – medical, industrial, naturally occurring radioactive material (NORM), or threat (e.g., SNM). The higher the isotope resolution, the sharper the fingerprint, and the better the identification but the cost of acquisition and sustainment raises substantially.

Cost per RIID can vary from $20,000 to $100,000 or more based on the isotope resolution capability, described in NIMS as low, medium, and high. In Appendix C, there is information on how to obtain NIMS Resource Typing Definitions for RIID's based on instrument capabilities and isotope resolution.

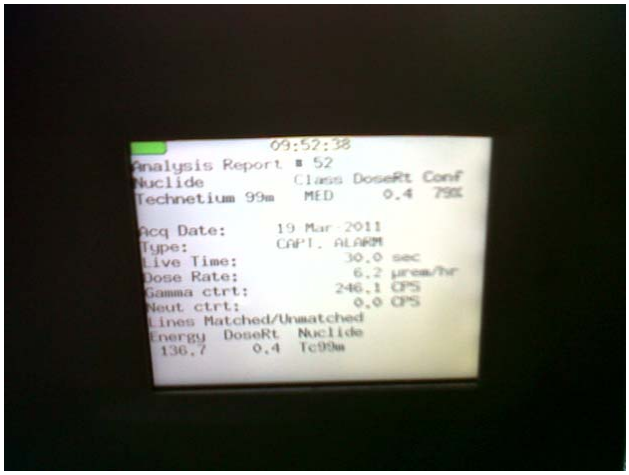

Figure 5. RIID Result Screen showing a Medical Isotope Tc99m

For this examination, the cost of a RIID is normalized as $20,000 with a $500 annual maintenance and calibration cost. The cost of training will be estimated at 16 hours at a nominal rate of $1,000 total. The Department of Homeland Security offers approved courses to educate law enforcement officers in the deployment of RIIDs. Homeland security grant funds may be expended to receive this training. These cost estimates are used throughout the policy option analysis.

d. Mobile Systems (Vehicle, Airborne, Marine)

Mobile systems are quite simply primary screening tools like PRDs and Radiation Detection Backpacks that are mounted to vehicles, aircraft, or marine vessels. They typically employ much larger sensors than the PRDs or backpacks and are used to survey larger geographical areas such as ports, neighborhoods, or cities. Most systems also include GPS and mapping features.

Cost per mobile system can vary from $80,000 to $300,000 or more based on the functions and whether or not it can detect neutron radiation and whether it can perform isotope identification like a RIID. In Appendix C, there is information on how to obtain NIMS Resource Typing Definitions for mobile systems based on instrument capabilities. There are some mobile systems in the NIMS typing (Type I) that perform secondary screening including isotope identification, which greatly increases the cost and subsequently they are not widely used due to an average cost of $200,000 to $300,000.

Figure 6. Removable Mobile System and Display/Mapping Unit (Can be deployed in vehicle, boat, or helicopter)

For this examination, the cost of a mobile system is normalized to $100,000 with a $5,000 annual maintenance and calibration cost. The cost of training will be estimated at eight hours at a nominal rate of $500 total. The Department of Homeland Security offers approved courses to educate law enforcement officers in the deployment of mobile systems. Homeland security grant funds may be expended to receive this training. These cost estimates are used throughout the policy option analysis.

e. Summary Matrix

Table 9 displays the costs associated with each type of equipment to include purchase, training, and sustainment:

Table 9. Detection Equipment Matrix

Equipment Type	Average Initial Cost	Time Required for Training	Cost for Training	Annual Costs for Maintenance and Calibration
Personal Radiation Detector (PRD)	$1000	8hrs	$500	$100
Radiation Detection Backpack	$45,000	8hrs	$500	$1000
Radiological Isotope Identification Device (RIID)	$20,000	16hrs	$1000	$500
Mobile Detection System (MDS)	$100,000	8hrs	$500	$5000

APPENDIX C. PREVENTIVE RADIOLOGICAL NUCLEAR DETECTION NIMS TYPING INFORMATION

The National Incident Management System (NIMS) resource library includes a dedicated treatment of Preventive Radiological / Nuclear Detection (PRND) Team compositions and equipment types to assist agencies measure capability against a set of national standards. The NIMS typing also allows for agencies to better utilize homeland security grant funding for implementation and sustainment of this mission.

Unfortunately, at the time of this thesis' publication, the NIMS Typing Document carries the restrictive marking "FOR OFFICIAL USE ONLY (FOUO)" and cannot be fully contained in this document as originally intended.

Interested agencies can request a copy of the full NIMS typing document by contacting the Domestic Nuclear Detection Office (DNDO) at the following email address:
DNDO.SLA@dhs.gov

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